

NAVAL BIODYNAMICS LABORATORY
NBDL-93R010

OPERATING PROCEDURES FOR ANTHROPOOMETRY AND INITIAL CONDITIONS PHOTOGRAHMETRIC PROGRAM

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Software Documentation

March 1994

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Prepared for

**Naval Medical Research and Development Command
Bethesda, MD 20889-5044**

19950227 087

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REPORT DOCUMENTATION PAGE

*Form Approved
OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204 Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

| | | | | |
|---|------------------------------|--|---|----------------------------|
| 1. AGENCY USE ONLY /Leave Blank/ | 2. REPORT DATE March 1994 | 3. REPORT TYPE AND DATES COVERED Final | | |
| 4. TITLE AND SUBTITLE Operating Procedures for Anthropometry and Initial Conditions Photogrammetric Program | | 5. FUNDING NUMBERS 63216 M0097.001 | | |
| 6. AUTHOR(S) Dorothy A. Francis | | | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Biodynamics Laboratory P. O. Box 29407 New Orleans LA 70189-0407 | | 8. PERFORMING ORGANIZATION REPORT NUMBER NBDL-93R010 | | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Medical Research and Development Command National Naval Medical Center Building 1, Tower 12 Bethesda, MD 20889-5044 | | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER NTIS CRA&I <input checked="" type="checkbox"/> DTIC TAB <input type="checkbox"/> Unannounced <input type="checkbox"/> Justification | | |
| 11. SUPPLEMENTARY NOTES | | By _____ Distribution / _____ | | |
| 12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited. | | 12b. DISTRIBUTION CODES Dist Avail and/or Special A*1 _____ | | |
| 13. ABSTRACT /Maximum 200 words/ This publication provides documentation of the Anthropometry and Initial Conditions Photogrammetric Program used on an IBM-compatible 486 personal computer at the Naval Biodynamics Laboratory in New Orleans, LA. | | | | |
| 14. SUBJECT TERMS Anthropometry; transformation; computer software. | | 15. NUMBER OF PAGES 188 | | |
| 17. SECURITY CLASSIFICATION OF REPORT Unclassified | | 18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified | 19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified | 20. LIMITATION OF ABSTRACT |

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OPERATING PROCEDURES FOR ANTHROPOMETRY AND INITIAL CONDITIONS PHOTOGRAMMETRIC PROGRAM

Introduction

The Naval Biodynamics Laboratory (NAVBIODYNLAB), located in New Orleans, Louisiana, is a research facility under the cognizance of the Naval Medical Research and Development Command. It is the principal Navy laboratory conducting biomedical research on the effects of mechanical forces encountered in Navy aircrafts and ships. Among its goals are the establishment of human tolerance limits and the development of appropriate methods of avoiding and treating the deleterious effects of such forces. Ongoing research programs at the laboratory acquire sensor and photographic impact acceleration data from acceleration sled runs.

To analyze this data, certain anthropometric information about each subject is necessary. Two anatomical coordinate systems are used, one on the head and one at the base of the neck on the first thoracic vertebra (T-1); these systems are depicted in Figures 1 and 2. The methodology for defining them and for obtaining the appropriate data has been reported previously (Becker, 1977). Motion data collected from inertial instrumentation packages on the head and T-1 are referenced to their own coordinate system; thus knowledge of the transformation matrices from the instrument to the anatomical coordinate systems is also required.

Neck and body information is obtained from two sets of stereoscopic X-rays of the subject with instrument mounts in place. X-rays are taken of T-1, and a set of calibration X-rays is made utilizing a Plexiglass™ target containing an array of radio-opaque BBs located at known positions. A special chair with additional BBs is used to ensure that the subject does not move while a stereoscopic pair of X-rays is made. This "stereopair" consists of two X-rays of the same area taken from different positions so as to afford stereoscopic vision. Two sets of stereopairs (a total of four X-rays) are taken as follows:

- Left eye view — left shoulder to plate
- Right eye view — left shoulder to plate
- Left eye view — right shoulder to plate
- Right eye view — right shoulder to plate

The X-rays are viewed through a mirror stereoscope, a lensed instrument used to view stereopairs. The X-rays are positioned until they form a stereomodel, i.e., a three-dimensional model formed by the intersecting of an overlapping pair of images. Once a stereomodel is formed, the X-rays are secured in place and, using the stereoscope, the points defining the anatomical coordinate system (Figure 1) are marked on the X-ray for digitization.

The method of head anthropometry used previously required two X-rays, which gave a minimally determined solution for the head anatomic coordinate system. To obtain a better solution it was necessary to expose the subject's head to increased radiation. To avoid this additional exposure, optical photogrammetry is used to determine head anthropometry data. Six photographs are taken using the

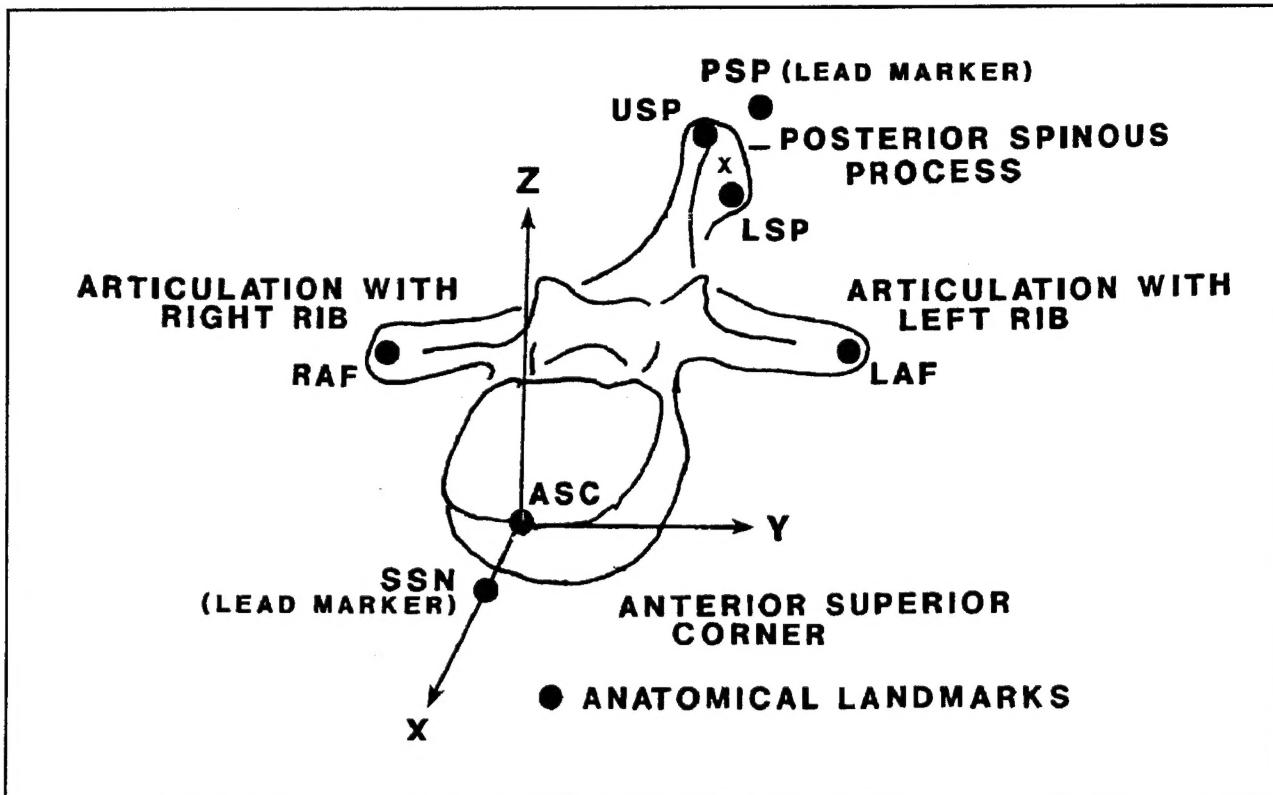


Figure 1. The T₁ Anatomical Coordinate System.

cameras located in the site survey. Photo coordinates are obtained from enlargements using the Altek digitizer.

The optical photogrammetry system used for the initial conditions of accelerator runs is also used for head anthropometry. Control points for a simultaneous block adjustment of the six-camera system have already been determined from the site survey. A test subject is seated on the vertical accelerator chair. The ocular notches are marked with a felt-tip pencil, the mouth mount with BB targets is fitted into place, and ear plugs with the ear targets attached are inserted under a doctor's supervision. All six cameras are fired simultaneously. The film is processed and enlargements made, with prints showing all format edges of each negative. These enlargements are digitized on the Altek digitizer, as described later.

The software package used is NGIANT, a customized version of PC GIANT. PC GIANT is an expanded and enhanced version of the General Integrated Analytical Triangulation program (GIANT), which is a public domain program for mainframe computers. Developed by Elassal et al for Autometric Corporation and later for the U.S. Geological Survey, GIANT will perform a simultaneous bundle adjustment of perspective imagery (photos, X-rays, etc.) by enforcing the collinearity condition. PREP is the pre-processor for transforming comparator coordinates to a plate-centered coordinate system with various corrections for systematic errors. NPREP, a custom version of PREP, was developed by GPA Associates to automate the digitization process and to create the GIANT input image file. NPREP creates the image file for NGIANT for a particular subject by human research volunteer (HRV) number. NGIANT will find all the necessary points in space and compute the locations of the specific body points by regression on the x,y,z coordinates of the targets or known locations. NGIANT then has all the

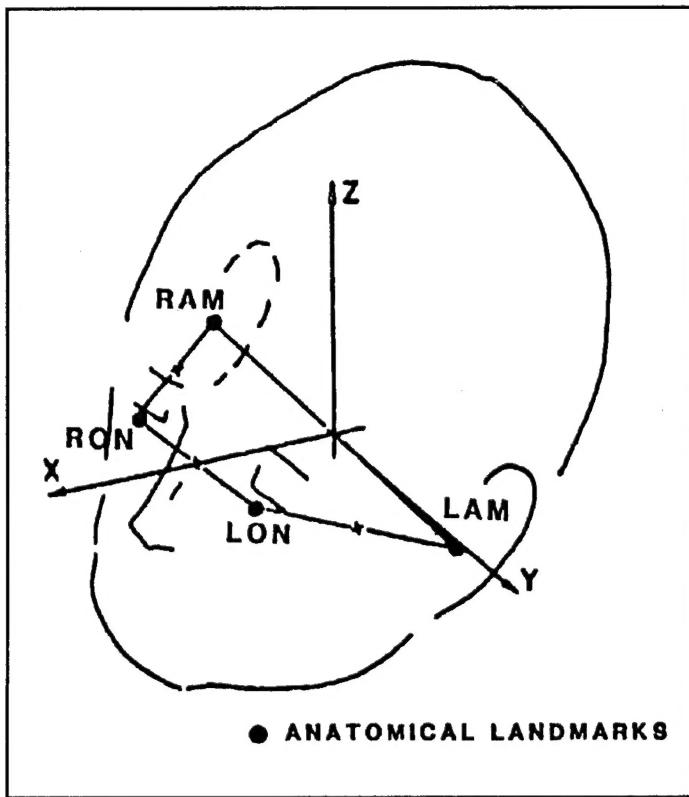


Figure 2. The Head Anatomical Coordinate System.

the firing sequence and are simultaneously exposed a fraction of a second prior to the impact pulse. Enlargements are processed on the Altek digitizer using NPREP. The resulting image file is then read into NGIANT. The output has the locations of the digitized targets on the mouth and T-1 mounts. The particular targets may change with the design of the new sensor package.

Function

The photogrammetric software package consists of two main programs:

| | | |
|--------|---|---|
| NGIANT | - | Main program which executes GIANT and calculates the transformation from the anatomical to the instrumentation coordinate system. All input must already be in place. |
| NPREP | - | Main Digitization program, which automates the digitization process and creates the NGIANT input image file for a particular subject by HRV number. |

ALTEK Digitizer

The ALTEK AC30 digitizer is connected on a bi-directional serial port to a 486 personal computer on the COM2 port. ALTEK Corporation's MICRODIJ Universal Digitizer Software is used to interface the personal computer with the digitizer. The use of MICRODIJ is invisible to the user because all the necessary commands have been incorporated into NPREP. The user need only know how to operate the digitizer cursor. The cursor has a viewing site with a set of cross hairs, and its controls have four push buttons and two warning lights.

The center of the cross hairs on the cursor should be positioned on the center of the point to be digitized. The red light will come on when the cursor is out of the digitizing range. The white light comes on when data has been transmitted. The control buttons are defined as follows:

| | |
|--------|--------------------------|
| YELLOW | = MISSING |
| RED | = ERROR-BACKUP |
| GREEN | = FIDUCIAL OR DATA POINT |
| BLUE | = ABORT PHOTO |

The green button is used to enter data. If a point is missing (i.e., it cannot be seen on a particular photo or X-ray), the yellow button is pressed. The red button is used when mistakes occur. The blue button is also used for mistakes, but only mistakes regarding photographs. If data for the photo being processed is erroneous, the complete data set may be aborted by pressing the blue button. If the wrong point(s) are input, the red button should be pressed to back up until the correct point is reached. All input is displayed on the screen. Data points will be labelled with X and Y coordinates printed. Missing points and deleted (back up) points will be noted. The user just has to watch the screen. Table 1 summarizes the various digitizing input sequences.

NGIANT

NGIANT is an interactive program for executing a customized version of GIANT. All input files should be in place. The operator may select the following options:

- 0: Initial Conditions
- 1: Head Anthropometry
- 2: Body Anthropometry
- 3: Standard GIANT

After an option has been selected, the appropriate subroutine is executed. If option 0 is selected, the run number is requested. If option 3 is selected, a title for the GIANT output is requested. In both cases, GIANT is executed immediately after input, assuming all input files have been created. If option 1 or 2 is selected, an HRV number is requested. After receiving input, the files are searched for an image file labelled *old* with the given HRV number. If the file exists, GIANT is executed. If the file does not exist, an error will be noted and execution terminated. This is also true for options 0 and 3.

| Table 1. Summary of the Various Digitizing Sequences | |
|--|--|
| Initial Conditions | |
| Fiducials | top 1, top 2, top 3, rt 1, rt 2, rt 3, bot 1, bot 2, bot 3, 1ft 1, 1ft 2, 1ft 3 |
| Targets | mrc1, mrc2, mrc3, mrc4, mrc5, mrc6, mrc7, mrc8, mcc1, mcc2, mcc3, mcc4, mcc5, mcc6, mcc7, mcc8, m1c1, m1c2, m1c3, m1c4, m1c5, m1c6, m1c7, m1c8, nrc1, nrc2, nrc3, nrc4, nrc5, nrc6, nrc7, nrc8, ncc1, ncc2, ncc3, ncc4, ncc5, ncc6, ncc7, ncc8, n1c1, n1c2, n1c3, n1c4, n1c5, n1c6, n1c7, n1c8, |
| Control | a, b, c, d, f, g, h, j, k, rtc1, rtc2, rtc3, rtc4, rtc5, rtc6, rtc7, rtc8, cen1, cen2, cen3, cen4, cen5, cen6, cen7, cen8, 1fc1, 1fc2, 1fc3, 1fc4, 1fc5, 1fc6, 1fc7, 1fc8 |
| Head Anthropometry | |
| Fiducials | top 1, top 2, top 3, rt 1, rt 2, rt 3, bot 1, bot 2, bot 3, lft 1, lft 2, lft 3 |
| Targets | ron, 1on, ear1-r, ear2-r, ear3-r, ear4-r, ear1-1, ear2-1, ear3-1, ear4-1, |
| Controls | mrc1, mrc2, mrc3, mrc4, mrc5, mrc6, mrc7, mrc8, mcc1, mcc2, mcc3, mcc4, mcc5, mcc6, mcc7, mcc8, m1c1, m1c2, m1c3, m1c4, m1c5, m1c6, m1c7, m1c8, |
| Body Anthropometry | |
| Fiducials | 1 2 3 4 5 6 7 8 9 10 |
| Targets | Origin, Rib_1f, Rib_Rt, SpineTop, SpineBot, spine_bb, sternum, 1f_shold, rt_shold, 1neckT, 1neckB, rneckT, rneckB, |
| Control | r1, r2, r3, r4, r5, r6, r7, r8, c1, c2, c3, c4, c5, c6, c7, c8, 11, 12, 13, 14, 15, 16, 17, 18 |

NPREP

NPREP is the main digitization and data acquisition program. It interfaces with the ALTEK digitizer to automate the digitization process and creates the NGIANT input image files for a particular subject. The operator may select the following options:

- 0: Initial Conditions
- 1: Head Anthropometry
- 2: Body Anthropometry

To execute NPREP, type NPREP. The COM port number for the Altek digitizer will be requested. Enter the number 2. The screen display will be as follows:

COM2: 9600, 0, 7, 2,-

Enter 0 for initial conditions.

Enter 1 for head anthropometry.

Enter 2 for body anthropometry.

Initial Conditions. If 0 is entered, "enter run number (a6):" will be displayed. The user will enter the run number. "Enter Photo #(1-6, 0 when finished)" will be displayed. The user will enter the number of the photo to be digitized. Finally, the user will be asked to enter specific targets in a predetermined order.

All photos are enlarged with a distinct edge or border so as to depict the area of interest in a well defined block. To establish reference points or calibrated fiducials, three arbitrary measurements are taken in a straight line along the edges of each photo. These are always the first points to be digitized. The sequence is top, right, bottom, and left. The user will be requested to digitize the points as follows:

- Enter: top 1 (Digitize 1st point on top edge.)
- Enter: top 2
- Enter: top 3
- Enter: rt 1 (Digitize 1st point on right edge.)
- Enter: rt 2
- Enter: rt 3
- Enter: bot 1 (Digitize 1st point on bottom edge.)
- Enter: bot 2
- Enter: bot 3
- Enter: lft 1
- Enter: lft 2
- Enter: lft 3 (Digitize last point on left edge.)

The data is analyzed and error values are displayed. The user should check the rms values. These should always be very small, definitely less than 1.0. The user will be given the option to continue. If

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the rms values are too large, the user should exit the program and start over.

Once the reference points are entered correctly, the user will be requested to digitized the targets as follows:

Enter: a (Digitize target A.)
Enter: b
Enter: c
Enter: d
Enter: f
Enter: g
Enter: h
Enter: j
Enter: k
Enter: rtc1 (Digitize corner 1 of right cube.)
Enter: rtc2
Enter: rtc3
Enter: rtc4
Enter: rtc5
Enter: rtc6
Enter: rtc7
Enter: rtc8
Enter: cen1 (Digitize corner 1 of center cube.)
Enter: cen2
Enter: cen3
Enter: cen4
Enter: cen5
Enter: cen6
Enter: cen7
Enter: cen8
Enter: lfc1 (Digitize corner 1 of left cube.)
Enter: lfc2
Enter: lfc3
Enter: lfc4
Enter: lfc5
Enter: lfc6
Enter: lfc7
Enter: lfc8

“Press Enter to Continue” is displayed. Press Enter.

Runs before LZ0930 are processed as follows:

Enter: m-r1 (Digitize corner 1 of cube on right side of mouth mount.)
Enter: m-r4 (Digitize corner 4 of cube on right side of mouth mount.)
Enter: m-t1 (Digitize corner 1 of cube on top part of mouth mount.)
Enter: m-t4 (Digitize corner 4 of cube on top part of mouth mount.)

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Enter: m-b1 (Digitize corner 1 of cube on bottom part of mouth mount.)
Enter: m-b4 (Digitize corner 4 of cube on bottom part of mouth mount.)
Enter: m-11 (Digitize corner 1 of cube on left side of mouth mount.)
Enter: m-14 (Digitize corner 4 of cube on left side of mouth mount.)
Enter: t-r1 (Digitize corner 1 of cube on right side T-plate.)
Enter: t-r4 (Digitize corner 4 of cube on right side of T-plate.)
Enter: t-c1 (Digitize corner 1 of cube on center of T-plate.)
Enter: t-c4 (Digitize corner 4 of cube on center of T-plate.)
Enter: t-11 (Digitize corner 1 of cube on left side of T-plate.)
Enter: t-14 (Digitize corner 4 of cube on left side on T-plate.)

Runs LZ0930 through the present are processed as follows:

Enter: mrc1 (Digitize corner 1 of right cube on the mouth mount.)
Enter: mrc2 (Digitize corner 2 of right cube on the mouth mount.)
Enter: mrc3 (Digitize corner 3 of right cube on the mouth mount.)
Enter: mrc4 (Digitize corner 4 of right cube on the mouth mount.)
Enter: mrc5 (Digitize corner 5 of right cube on the mouth mount.)
Enter: mrc6 (Digitize corner 6 of right cube on the mouth mount.)
Enter: mrc7 (Digitize corner 7 of right cube on the mouth mount.)
Enter: mrc8 (Digitize corner 8 of right cube on the mouth mount.)

Enter: mcc1 (Digitize corner 1 of the center cube on the mouth mount.)
Enter: mcc2 (Digitize corner 2 of the center cube on the mouth mount.)
Enter: mcc3 (Digitize corner 3 of the center cube on the mouth mount.)
Enter: mcc4 (Digitize corner 4 of the center cube on the mouth mount.)
Enter: mcc5 (Digitize corner 5 of the center cube on the mouth mount.)
Enter: mcc6 (Digitize corner 6 of the center cube on the mouth mount.)
Enter: mcc7 (Digitize corner 7 of the center cube on the mouth mount.)
Enter: mcc8 (Digitize corner 8 of the center cube on the mouth mount.)

Enter: mlc1 (Digitize corner 1 of the left cube on the mouth mount.)
Enter: mlc2 (Digitize corner 2 of the left cube on the mouth mount.)
Enter: mlc3 (Digitize corner 3 of the left cube on the mouth mount.)
Enter: mlc4 (Digitize corner 4 of the left cube on the mouth mount.)
Enter: mlc5 (Digitize corner 5 of the left cube on the mouth mount.)
Enter: mlc6 (Digitize corner 6 of the left cube on the mouth mount.)
Enter: mlc7 (Digitize corner 7 of the left cube on the mouth mount.)
Enter: mlc8 (Digitize corner 8 of the left cube on the mouth mount.)

Enter: nrc1 (Digitize corner 1 of the right cube on the neck mount.)
Enter: nrc2 (Digitize corner 2 of the right cube on the neck mount.)
Enter: nrc3 (Digitize corner 3 of the right cube on the neck mount.)
Enter: nrc4 (Digitize corner 4 of the right cube on the neck mount.)
Enter: nrc5 (Digitize corner 5 of the right cube on the neck mount.)
Enter: nrc6 (Digitize corner 6 of the right cube on the neck mount.)

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Enter: nrc7 (Digitize corner 7 of the right cube on the neck mount.)
Enter: nrc8 (Digitize corner 8 of the right cube on the neck mount.)

Enter: ncc1 (Digitize corner 1 of the center cube on the neck mount.)
Enter: ncc2 (Digitize corner 2 of the center cube on the neck mount.)
Enter: ncc3 (Digitize corner 3 of the center cube on the neck mount.)
Enter: ncc4 (Digitize corner 4 of the center cube on the neck mount.)
Enter: ncc5 (Digitize corner 5 of the center cube on the neck mount.)
Enter: ncc6 (Digitize corner 6 of the center cube on the neck mount.)
Enter: ncc7 (Digitize corner 7 of the center cube on the neck mount.)
Enter: ncc8 (Digitize corner 8 of the center cube on the neck mount.)

Enter: nlc1 (Digitize corner 1 of the left cube on the neck mount.)
Enter: nlc2 (Digitize corner 2 of the left cube on the neck mount.)
Enter: nlc3 (Digitize corner 3 of the left cube on the neck mount.)
Enter: nlc4 (Digitize corner 4 of the left cube on the neck mount.)
Enter: nlc5 (Digitize corner 5 of the left cube on the neck mount.)
Enter: nlc6 (Digitize corner 6 of the left cube on the neck mount.)
Enter: nlc7 (Digitize corner 7 of the left cube on the neck mount.)
Enter: nlc8 (Digitize corner 8 of the left cube on the neck mount.)

"Enter Photo # (1-6, 0 when finished)" will be displayed at the end of processing. Repeat the above steps for each photo to be digitized. Enter 0 at this prompt when you have digitized the last photo.

Head Anthropometry. After entering the number 1 as the processing option, the display will be: "Enter HRV number." The user will enter a four digit integer as the human research volunteer number (i.e., 0222 for HRV number H-222). The following will be printed: "Default ear offsets are: 5.420", 5.420", OK?" Press the RETURN key to accept these defaults, any other key to change them. If the user presses RETURN, processing will continue. "Enter left and right ear offsets:" will be displayed if anything else is entered. The user will be given this information before processing.

The files are then searched to insure that new data is being processed. If data for the given subject exists, the program will terminate and the user will be notified that the data already exists. If the data does not exist, the user will be requested to digitize the points as follows:

The edges, targets A-K, the right cube corners, the center cube corners, and the left cube corners are digitized in the same sequence as for initial conditions. (See Initial Conditions section, page 6). The head anthropometry data is requested after all reference points have been digitized. The input for runs before LZ0930 is as follows:

Enter: rtp (Digitize right side of T-plate.)
Enter: ctp (Digitize center of T-plate.)
Enter: ltp (Digitize left side of T-plate.)
Enter: ron (Digitize right orbital notch (eye).)
Enter: lon (Digitize left orbital notch (eye).)
Enter: ear1-r (Digitize right ear target farthest away from head.)
Enter: ear2-r (Digitize 2nd farthest right ear target.)

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Enter: ear3-r (Digitize 2nd closest right ear target.)
Enter: ear4-r (Digitize right ear target closest to head.)
Enter: ear1-l (Digitize left ear target farthest away from head.)
Enter: ear2-l (Digitize 2nd farthest left ear target.)
Enter: ear3-l (Digitize 2nd closest left ear target.)
Enter: ear4-l (Digitize left ear target closest to head.)

Runs from LZ0930 and above are processed as follows:

Enter: ron (Digitize right orbital notch eye.)
Enter: lon (Digitize left orbital notch (eye).)
Enter: ear1-r (Digitize right ear target farthest away from head.)
Enter: ear2-r (Digitize 2nd farthest right ear target.)
Enter: ear3-r (Digitize 2nd closest right ear target.)
Enter: ear4-r (Digitize right ear target closest to head.)
Enter: ear1-l (Digitize left ear target farthest away from head.)
Enter: ear2-l (Digitize 2nd farthest left ear target.)
Enter: ear3-l (Digitize 2nd closest left ear target.)
Enter: ear4-l (Digitize left ear target closest to head.)
Enter: mrc1 (Digitize corner 1 of the right cube on the mouth mount.)
Enter: mrc2 (Digitize corner 2 of the right cube on the mouth mount.)
Enter: mrc3 (Digitize corner 3 of the right cube on the mouth mount.)
Enter: mrc4 (Digitize corner 4 of the right cube on the mouth mount.)
Enter: mrc5 (Digitize corner 5 of the right cube on the mouth mount.)
Enter: mrc6 (Digitize corner 6 of the right cube on the mouth mount.)
Enter: mrc7 (Digitize corner 7 of the right cube on the mouth mount.)
Enter: mrc8 (Digitize corner 8 of the right cube on the mouth mount.)
Enter: mcc1 (Digitize corner 1 of the center cube on the mouth mount.)
Enter: mcc2 (Digitize corner 2 of the center cube on the mouth mount.)
Enter: mcc3 (Digitize corner 3 of the center cube on the mouth mount.)
Enter: mcc4 (Digitize corner 4 of the center cube on the mouth mount.)
Enter: mcc5 (Digitize corner 5 of the center cube on the mouth mount.)
Enter: mcc6 (Digitize corner 6 of the center cube on the mouth mount.)
Enter: mcc7 (Digitize corner 7 of the center cube on the mouth mount.)
Enter: mcc8 (Digitize corner 8 of the center cube on the mouth mount.)

Enter: mlc1 (Digitize corner 1 of the left cube on the mouth mount.)
Enter: mlc2 (Digitize corner 2 of the left cube on the mouth mount.)
Enter: mlc3 (Digitize corner 3 of the left cube on the mouth mount.)
Enter: mlc4 (Digitize corner 4 of the left cube on the mouth mount.)
Enter: mlc5 (Digitize corner 5 of the left cube on the mouth mount.)
Enter: mlc6 (Digitize corner 6 of the left cube on the mouth mount.)
Enter: mlc7 (Digitize corner 7 of the left cube on the mouth mount.)
Enter: mlc8 (Digitize corner 8 of the left cube on the mouth mount.)

"Enter photo #(1-6, 0 when finished)" will be displayed at the end of processing. Repeat the above

steps for each photo to be digitized. Enter 0 to this prompt when you have digitized the last photo.

Body (Neck) Anthropometry. As discussed earlier, the neck anthropometry is obtained from X-rays. This will be referred to as *body anthropometry* because in this new procedure more than the neck is considered. After the number 2 is entered as the processing option, the display will be: "Enter HRV number." The user will enter a four digit integer as the HRV number (i.e., 0222 would be entered for HRV number H-222). If a data file exists for the given subject, the program will terminate with a file error. No specific details will be relayed to the user. If the data does not exist, processing will continue and the following will be displayed: "Enter number of parameters for shrinkage fit:" The user will input the number 8, and the following will appear:

Enter 0 when finished

Enter 1 if: Left eye view-left shoulder to plate

Enter 2 if: Right eye view-left shoulder to plate

Enter 3 if: Left eye view-right shoulder to plate

Enter 4 if: Right eye view-right shoulder to plate

The number to be entered is determined by the X-ray being digitized. The numbers 1 through 4 represent the four X-rays discussed earlier. The T-1 anatomical coordinate system (Figure 1) should have been marked on these X-rays in stereo before digitization. The user will be requested to digitize the points as outlined in Figure 3 or Figure 4.

Fiducials 1 through 10 are entered first. The user must follow the sequence indicated in Figures 3 and 4. There is no prompting. However, the data entered is printed on the screen to ensure proper entry. The user must check the screen to verify correct digitization.

The input will be as follows:

Fiducial 1 (Input carefully; you will have to re-enter it to close out.)

.

.

.

Fiducial 10

As with the others, an error value will be printed. Check the rms value; it must be less than one. If not, the data is erroneous and you must start over.

Runs before LZ0930 are processed as follows:

Origin

Rib-lf (Left Rib Articulation)

Rib-rt (Right Rib Articulation)

Spine Top (Top Spinous Process)

Spine Bot (Bottom Spinous Process)

Spine-bb (Posterior Spinous Process)

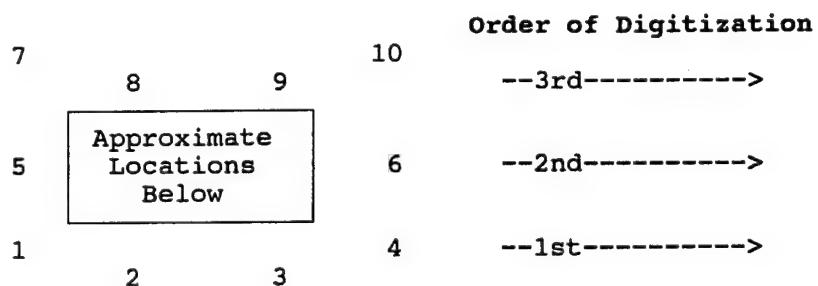
Sternum

lf-shold (Left Shoulder)

rt-shold (Right Shoulder)

VIEW OF AN X-RAY

Locations of Fiducials on X-ray



Approximate Body Locations on X-ray

| | | | |
|----------|----------|----------|-----|
| rneckT | lneckT | | |
| | | | |
| | | rtp | ctp |
| rneckB | lneckB | | ltp |
| rt_rib | lf_rib | spine_bb | |
| | top_spin | | |
| | bot_spin | | |
| | origin | | |
| | | | |
| rt_shold | sternum | lf_shold | |

Fiducials 1 - 10 are entered first then proceed as follows:

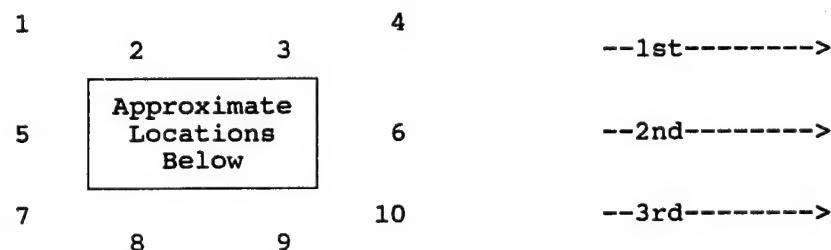
| | | | |
|-----------|-----------------------------|--------|-------------------------|
| Origin | | ltp | (Left Side of T-Plate) |
| Rib-lf | (Left Rib Articulation) | rtp | (Right side of T-Plate) |
| Rib-rt | (Right Rib Articulation) | ctp | (Center of T-Plate) |
| Spine Top | (Top Spinous Process) | lneckT | (Left Neck Top) |
| Spine Bot | (Bottom Spinous Process) | lneckB | (Left Neck Bottom) |
| Spine-bb | (Posterior Spinous Process) | rneckT | (Right Neck Top) |
| Sternum | | rneckB | (Right Neck Bottom) |
| lf_shold | (Left Shoulder) | | |
| rt_shold | (Right Shoulder) | | |

Figure 3. X-ray anthropometry digitization schematic diagram: Pre-mount modification — T-plate.

VIEW OF AN X-RAY

Locations of Fiducials on X-ray

Order of Digitization



Approximate Body Locations on X-ray

lneckT

```
rneckB      lneckB
            rt_rib   lf_rib   spine_bb
                           top_spin
                           bot_spin
                           origin
```

rt shold sternum

1f shold

| Fiducials 1 - 10 are entered first then proceed as follows: | | | |
|---|-----------------------------|-------------------------------------|------------------------|
| Origin | | rneckB | (Right Neck Bottom) |
| Rib-lf | (Left Rib Articulation) | r1 | (Right Cube Corner 1) |
| Rib-rt | (Right Rib Articulation) | . | |
| Spine Top | (Top Spinous Process) | r8 | (Right Cube Corner 8) |
| Spine Bot | (Bottom Spinous Process) | c1 | (Center Cube Corner 1) |
| Spine-bb | (Posterior Spinous Process) | . | |
| Sternum | | c8 | (Center Cube Corner 8) |
| lf-shold | (Left Shoulder) | l1 | (Left Cube Corner 1) |
| rt-shold | (Right Shoulder) | . | |
| lneckT | (Left Neck Top) | 18 | (Left Cube Corner 8) |
| lneckB | (Left Neck Bottom) | Note: r1 is digitized after rneckB. | |
| rneckT | (Right Neck Top) | | |

Figure 4. X-ray Anthropometry Digitizing Schematic Diagram: Post Mount Modification — No T-plate.

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| | |
|--------|-------------------------|
| ltp | (Left Side of T-Plate) |
| rtp | (Right side of T-Plate) |
| ctp | (Center of T-Plate) |
| lneckT | (Left Neck Top) |
| lneckB | (Left Neck Bottom) |
| rneckT | (Right Neck Top) |
| rneckB | (Right Neck Bottom) |

Re-do first fiducial (Re-digitize the first point you digitized)

Runs from LZ0930 and above are processed as follows:

| | |
|-----------|-----------------------------|
| Origin | |
| Rib-lf | (Left Rib Articulation) |
| Rib-rt | (Right Rib Articulation) |
| Spine Top | (Top Spinous Process) |
| Spine Bot | (Bottom Spinous Process) |
| Spine-bb | (Posterior Spinous Process) |
| Sternum | |
| lf-shold | (Left Shoulder) |
| rt-shold | (Right Shoulder) |
| lneckT | (Left Neck Top) |
| lneckB | (Left Neck Bottom) |
| rneckT | (Right Neck Top) |
| rneckB | (Right Neck Bottom) |
| r1 | (Right Cube Corner 1) |
| r2 | (Right Cube Corner 2) |
| r3 | (Right Cube Corner 3) |
| r4 | (Right Cube Corner 4) |
| r5 | (Right Cube Corner 5) |
| r6 | (Right Cube Corner 6) |
| r7 | (Right Cube Corner 7) |
| r8 | (Right Cube Corner 8) |
| c1 | (Center Cube Corner 1) |
| c2 | (Center Cube Corner 2) |
| c3 | (Center Cube Corner 3) |
| c4 | (Center Cube Corner 4) |
| c5 | (Center Cube Corner 5) |
| c6 | (Center Cube Corner 6) |
| c7 | (Center Cube Corner 7) |
| c8 | (Center Cube Corner 8) |
| 11 | (Left Cube Corner 1) |
| 12 | (Left Cube Corner 2) |

| | |
|----|----------------------|
| 13 | (Left Cube Corner 3) |
| 14 | (Left Cube Corner 4) |
| 15 | (Left Cube Corner 5) |
| 16 | (Left Cube Corner 6) |
| 17 | (Left Cube Corner 7) |
| 18 | (Left Cube Corner 8) |

Re-do first fiducial (Re-digitize the first point you digitized)

Repeat the above steps for each X-ray.

Note that the user should be especially careful when digitizing fiducial 1. This is the close-out reference point. The first and last the data points entered are compared to check the accuracy of the data. If the difference between the two is too great, the user will be given four tries to read the point correctly. After four tries, the program will terminate and all the data will have to be re-entered.

Additional Information. Mounts similar to those shown in Figures 5 and 6 have been used on the mouth and neck to gain initial conditions, head anthropometry, and body anthropometry data. All references to right and left, for both photos and X-rays, are with respect to the subject. The right cube is on the subject's right and the left cube on the subject's left. The cubes are numbered as shown in Figure 7. The mount is in a different position when on the neck. Figure 8 shows the position of the mount when on the neck (lying down). Note that the numbering of the corners of the cubes have not changed. Only the positions of the cubes have changed.

Programs

The following program and subroutines are available:

| | |
|----------|--|
| DIGITIZE | — Main digitization program which digitizes data and creates the GIANT image data files (NPREP). |
| HEAD | — Digitizes head anthropometry and initial conditions. |
| BODY | — Digitizes body anthropometry. |
| FID | — Determines corner fiducials. |
| FOURP | — Calculates the three- or four-parameter transformations. |
| FIVEP | — Calculates the five-parameter transformation. |
| SIXP | — Calculates the six-parameter transformation. |
| EIGHTP | — Calculates the eight-parameter transformation. |

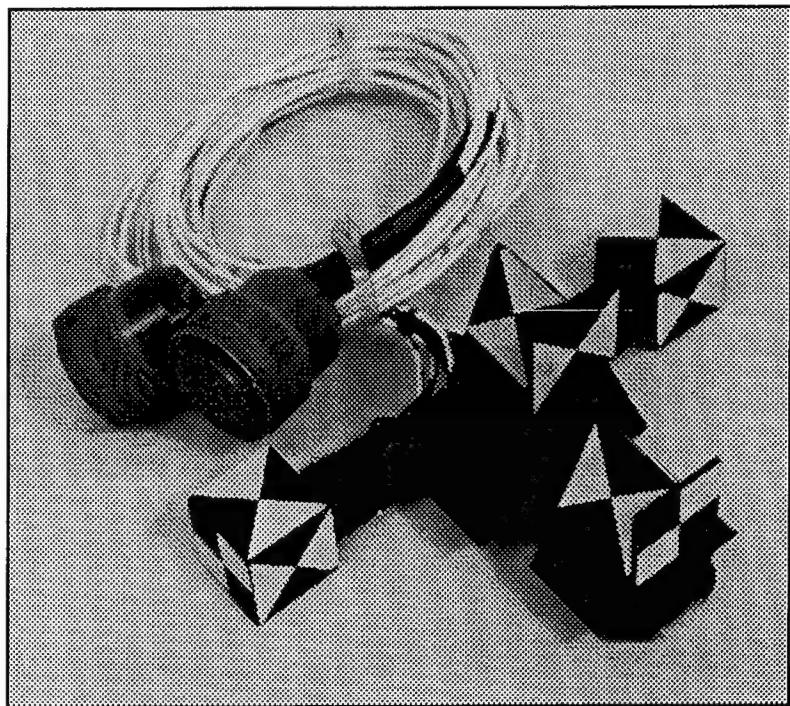


Figure 5. T-Plate Mount.

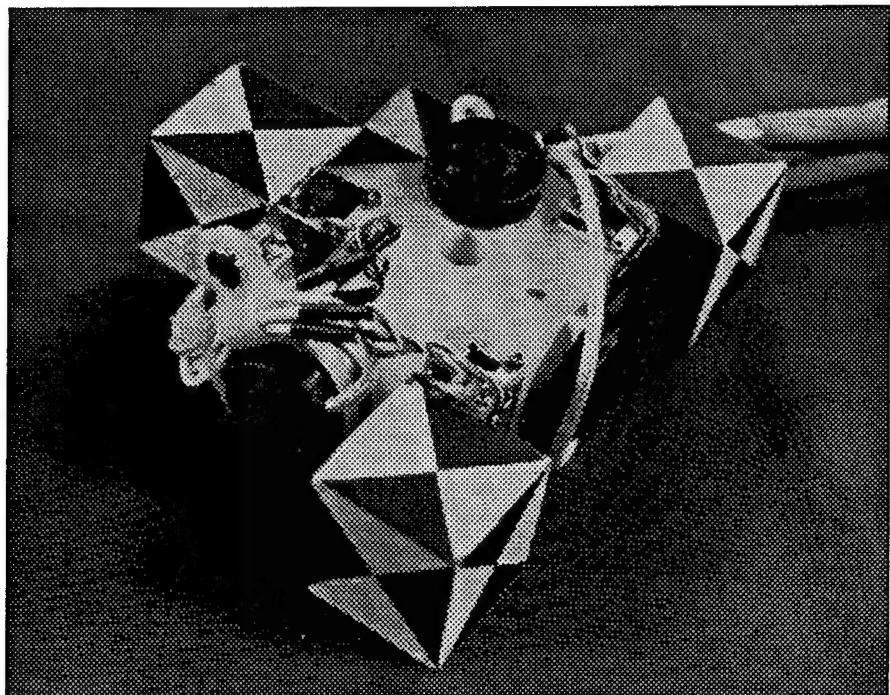


Figure 6. Photogrammetric Mount.

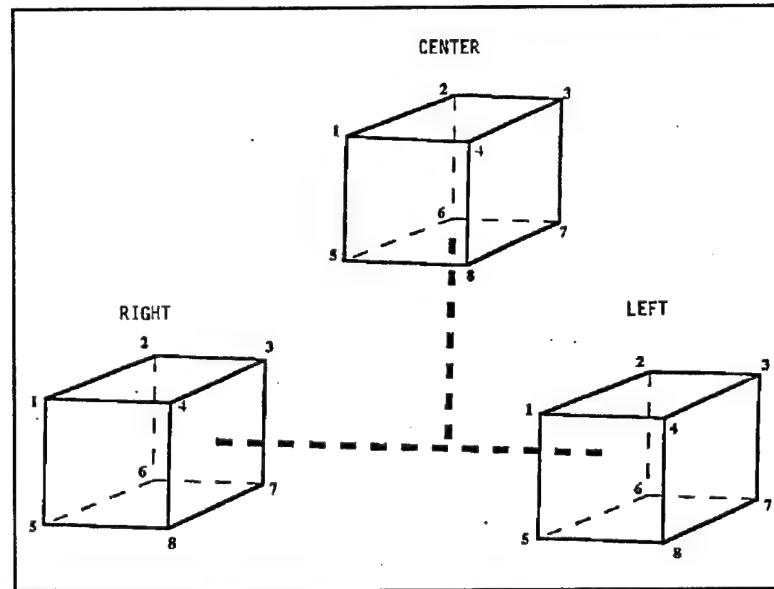


Figure 7. Corner Designations for Photogrammetry: Position on Mouth.

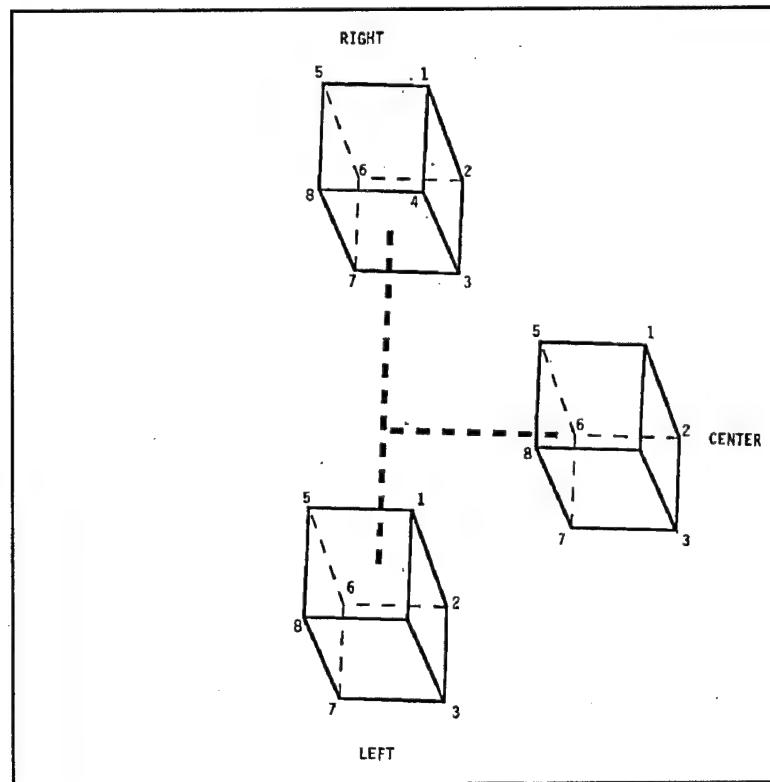


Figure 8. Corner Designations for Photogrammetry: Position of Neck.

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| | |
|--------|--|
| ACCAPR | — Acquires approximate values of the eight-parameter transformation. |
| ACCNEQ | — Acquires normal equations for the eight-parameter transformation. |
| INVERT | — Finds the inverse of a matrix. |
| LINSOL | — Solves linear equations. |
| CLEAR | — Clears the screen and moves the cursor to row 8. |
| NEWPAG | — Writes title and page number. |

Subroutine Descriptions

HEADS. The HEADS routine allows the operator to digitize head anthropometry or initial conditions photos. The call is:

CALL HEADS(IANS)

where

IANS = 0 for digitization of initial conditions
= 1 for digitization of head anthropometry

BODY. The BODY routine allows the operator to digitize body anthropometry X-rays. The call is:

CALL BODY

FID. The FID routine intersects the edge lines formed by a least squares solution on three points to give the corner fiducials. It also stores the output in the same array used for input. The call is:

CALL FID(Z)

where

Z = X, Y coordinates of three points along the four edges of the photo when Z is the input.

= The corner fiducials coordinates when Z is the output.

Anthropometry and Initial Conditions Photogrammetric Program

FOURP. The FOURP routine calculates the three- and four-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL FOURP

FIVEP. The FIVEP routine calculates the five-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL FIVEP

SIXP. The SIXP routine calculates the six-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL SIXP

EIGHTP. The EIGHTP routine calculates the eight-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL EIGHTP

ACCAPR. The ACCAPR routine evaluates the contribution of one point to the 8×9 matrix of normal equations for computation of approximate values of the eight-parameter film shrinkage transformation. The call is:

CALL ACCAPR(XG, YG, XP, YP)

where

XG = Calibrated X fiducial coordinate
YG = Calibrated Y fiducial coordinate
XP = Observed X fiducial coordinate
YP = Observed Y fiducial coordinate

EQN = 8×8 coefficient matrix of the Normal Equation with the vector of constants in column 9

ACCNEQ. The ACCNEQ routine evaluates the contribution of one point to the normal equation required for subroutine EIGHTP. The normal equations are required to compute corrections to the last estimate of the eight-transformation parameters. This routine is called once for each point. The call is:

CALL ACCNEQ(XG, YG, XP, YP)

where

XG = Calibrated X fiducial coordinate
YG = Calibrated Y fiducial coordinate
XP = Observed X fiducial coordinate
YP = Observed Y fiducial coordinate
EQN = 8×8 coefficient matrix of the Normal Equation with the vector of constants in column 9

INVERT. The INVERT routine finds the inverse of a matrix by the Gaussian Elimination Method. The routine will search for the largest non-singular matrix in the input array, invert it, and return the inverse in the same array. The call is:

CALL INVERT(A,N,D)

where

A = Array in which the matrix to be inverted is located and also the location of the inverted matrix that is returned.
N = The first dimension of array A when used in the call statement. It contains the rank of the largest matrix contained in A as a returned value.
D = The determinant of the largest non-singular matrix in A.

LINSOL. The LINSOL routine solves a specified number of linear equations with a specified number of unknowns. The call is:

CALL LINSOL(NPAR)

where

NPAR = The number of linear equations and the number of unknowns

CLEAR. The CLEAR routine clears the screen and moves the cursor to row eight. The call is:

CALL CLEAR

NEWPAG. The NEWPAG routine prints the title, page number, and any header information on each page. The call is:

CALL NEWPAG

Giant Subroutines Customized for NAVBIODYNLAB

Several subroutines were added to GIANT to enhance the program for use by NAVBIODYNLAB. These include the following subroutines:

| | |
|-------------|---|
| ANTHRO | — Verifies that the needed 13 head or 8 body points are available. This routine finds the transformations and prints the results. |
| EXTRAPOLATE | — Extrapolates anthropometry data. |
| GETICV | — Searches object point IDs for matching IDs of targets on the head, mouth, and neck. Desired variables are saved for the initial conditions data file. |
| ICONS | — Writes initial conditions data to a file. |
| NBDL | — Finds the origin and transformation matrices of the mount relative to the head/body anatomical origin in the anatomical coordinate system. |
| STUFFP | — Searches object point IDs to find matching IDs in the anthropometry list and stores object point data in corresponding locations in an array. |
| UVEC | — This routine creates a unit vector. |

Reference

Becker, E. B., "Stereoradiographic Measurements for Anatomically Mounted Instruments," *Proceedings of the Twenty-First STAPP Car Crash Conference*, Society of Automotive Engineers, Inc., Warrendale, PA, pp. 477-505, October, 1977.

Appendices

Appendix A Listings of Prep Output Files

Body Anthropometry Printed Output

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 1
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Calibrated Fiducial Coordinates of Frame LfEyLfSh

| Fid | X | Y |
|-----|----------|----------|
| 1 | -193.950 | 148.160 |
| 2 | -80.380 | 162.380 |
| 3 | 75.670 | 164.310 |
| 4 | 191.214 | 148.961 |
| 5 | -193.920 | -5.010 |
| 6 | 192.310 | -4.800 |
| 7 | -193.010 | -159.210 |
| 8 | -80.050 | -147.600 |
| 9 | 75.390 | -144.880 |
| 10 | 192.720 | -158.520 |

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Body Anthropometry for HRV # 00253

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Fiducial Measurements of Frame LfEyLfSh

| ID | Measured | |
|----|----------|---------|
| | X | Y |
| 1 | 79.426 | 328.828 |
| 2 | 193.294 | 343.332 |
| 3 | 348.945 | 345.897 |
| 5 | 80.645 | 175.463 |
| 6 | 466.141 | 177.749 |
| 8 | 195.428 | 33.884 |
| 9 | 350.190 | 37.135 |

8-Parameter Residuals of the Fiducial Coordinates

| Fid | X | Y |
|-----|--------|--------|
| 1 | -0.138 | 0.080 |
| 2 | 0.169 | -0.090 |
| 3 | -0.068 | -0.045 |
| 5 | 0.013 | -0.034 |
| 6 | 0.058 | 0.168 |

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| | | |
|-------------|--------|--------|
| 8 | 0.094 | 0.138 |
| 9 | -0.127 | -0.216 |
| Rms | 0.108 | 0.126 |
| Rms (check) | 0.300 | 0.206 |

Transformation Parameters Are:

| | | | | |
|-----------|----------|-----------|-----------|----------|
| 1.001305 | 0.005593 | -275.7444 | -0.000006 | 0.000006 |
| -0.004836 | 1.000885 | -180.2756 | | |

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Plate Coordinates for Frame LfEyLfSh

| ID | Measured | | Adjusted | |
|----------|----------|---------|----------|---------|
| | X | Y | X | Y |
| Origin | 392.684 | 196.063 | 118.707 | 14.080 |
| Rib_Lf | 392.405 | 185.572 | 118.376 | 3.568 |
| Rib_Rt | 343.433 | 206.654 | 69.359 | 24.925 |
| SpineTop | 306.248 | 199.390 | 32.043 | 17.823 |
| SpineBot | 302.311 | 189.509 | 28.043 | 7.946 |
| spine_bb | 276.987 | 197.028 | 2.708 | 15.596 |
| sternum | 404.876 | 100.863 | 130.484 | -81.443 |
| lf_shold | 304.571 | 91.186 | 29.776 | -90.609 |
| lneckT | 284.099 | 232.283 | 10.029 | 50.860 |
| lneckB | 282.245 | 164.922 | 7.797 | -16.586 |
| rneckT | 94.056 | 242.087 | -180.056 | 61.518 |
| rneckB | 93.091 | 160.071 | -181.569 | -20.506 |
| r1 | 208.661 | 284.251 | -65.197 | 103.179 |
| r2 | 209.423 | 258.293 | -64.590 | 77.216 |
| r3 | 217.449 | 261.341 | -56.539 | 80.230 |
| r4 | 218.694 | 296.418 | -55.086 | 115.302 |
| r5 | 229.387 | 281.711 | -44.472 | 100.553 |
| r6 | 230.226 | 256.184 | -43.783 | 75.017 |
| r7 | 241.859 | 260.071 | -32.115 | 78.854 |
| r8 | 242.087 | 294.361 | -31.688 | 113.149 |
| c1 | 193.192 | 281.940 | -80.686 | 100.933 |
| c2 | 192.557 | 255.448 | -81.482 | 74.444 |
| c3 | 198.933 | 261.163 | -75.069 | 80.132 |
| c4 | 200.990 | 294.589 | -72.809 | 113.547 |
| c5 | 212.801 | 280.238 | -61.078 | 99.149 |
| c6 | 212.928 | 254.991 | -61.102 | 73.898 |
| c7 | 223.520 | 259.740 | -50.473 | 78.603 |
| c8 | 223.291 | 290.805 | -50.519 | 109.671 |
| l1 | 279.654 | 285.420 | 5.871 | 104.052 |
| l2 | 279.070 | 257.099 | 5.129 | 75.719 |
| l3 | 298.475 | 258.953 | 24.577 | 77.490 |
| l4 | 299.796 | 287.757 | 26.057 | 106.306 |
| l5 | 298.298 | 283.464 | 24.533 | 102.017 |
| l6 | 297.967 | 256.210 | 24.053 | 74.747 |
| l7 | 318.389 | 256.896 | 44.519 | 75.345 |
| l8 | 317.170 | 285.725 | 43.451 | 104.200 |

Anthropometry and Initial Conditions Photogrammetric Program

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Calibrated Fiducial Coordinates of Frame RtEyLfSh

| Fid | X | Y |
|-----|----------|----------|
| 1 | -193.950 | 148.160 |
| 2 | -80.380 | 162.380 |
| 3 | 75.670 | 164.310 |
| 4 | 191.214 | 148.961 |
| 5 | -193.920 | -5.010 |
| 6 | 192.310 | -4.800 |
| 7 | -193.010 | -159.210 |
| 8 | -80.050 | -147.600 |
| 9 | 75.390 | -144.880 |
| 10 | 192.720 | -158.520 |

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Fiducial Measurements of Frame RtEyLfSh

| ID | Measured | |
|----|----------|---------|
| | X | Y |
| 1 | 112.192 | 337.490 |
| 2 | 226.136 | 351.282 |
| 3 | 382.219 | 352.704 |
| 4 | 498.500 | 336.982 |
| 5 | 111.684 | 184.302 |
| 6 | 498.780 | 183.007 |
| 8 | 225.273 | 41.123 |
| 9 | 380.670 | 42.901 |

8-Parameter Residuals of the Fiducial Coordinates

| Fid | X | Y |
|-----|--------|--------|
| 1 | -0.082 | 0.030 |
| 2 | 0.160 | -0.046 |
| 3 | -0.189 | -0.065 |
| 4 | 0.140 | -0.026 |
| 5 | -0.053 | 0.057 |
| 6 | 0.000 | 0.180 |
| 8 | 0.179 | 0.011 |
| 9 | -0.155 | -0.141 |

| | | |
|-------------|-------|-------|
| Rms | 0.135 | 0.089 |
| Rms (check) | 0.374 | 0.200 |

Transformation Parameters Are:

1.000134 -0.004064 -305.1258 0.000006 0.000002
0.004181 1.001018 -189.9147

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Plate Coordinates for Frame RtEyLfSh

| ID | Measured | | Adjusted | |
|----------|----------|---------|----------|---------|
| | X | Y | X | Y |
| Origin | 341.097 | 196.774 | 35.129 | 8.464 |
| Rib_Lf | 342.113 | 187.020 | 36.183 | -1.271 |
| Rib_Rt | 293.040 | 209.525 | -12.869 | 21.002 |
| SpineTop | 267.945 | 208.229 | -37.913 | 19.606 |
| SpineBot | 263.195 | 198.425 | -42.616 | 9.793 |
| spine_bb | 237.922 | 205.613 | -67.880 | 16.871 |
| sternum | 351.790 | 107.417 | 46.164 | -80.724 |
| lf_shold | 277.038 | 98.222 | -28.395 | -90.261 |
| lneckT | 257.962 | 240.386 | -48.006 | 51.687 |
| lneckB | 254.991 | 172.872 | -50.706 | -15.770 |
| r1 | 175.108 | 293.167 | -130.970 | 104.111 |
| r2 | 175.616 | 267.106 | -130.363 | 78.073 |
| r3 | 175.920 | 271.221 | -130.075 | 82.186 |
| r4 | 177.902 | 306.375 | -128.229 | 117.318 |
| r5 | 197.510 | 290.474 | -108.576 | 101.500 |
| r6 | 198.069 | 265.354 | -107.921 | 76.405 |
| r7 | 201.498 | 269.418 | -104.511 | 80.478 |
| r8 | 202.743 | 303.886 | -103.401 | 114.917 |
| c1 | 161.087 | 291.236 | -144.976 | 102.133 |
| c2 | 160.350 | 264.465 | -145.610 | 75.377 |
| c3 | 159.360 | 271.018 | -146.625 | 81.922 |
| c4 | 161.366 | 304.216 | -144.745 | 115.104 |
| c5 | 181.940 | 289.001 | -124.127 | 99.973 |
| c6 | 181.940 | 263.855 | -124.031 | 74.847 |
| c7 | 185.268 | 269.138 | -120.726 | 80.139 |
| c8 | 185.293 | 300.152 | -120.820 | 111.126 |
| 11 | 245.567 | 293.878 | -60.593 | 105.070 |
| 12 | 244.500 | 265.557 | -61.547 | 76.779 |
| 13 | 262.661 | 267.106 | -43.421 | 78.394 |
| 14 | 264.160 | 295.885 | -42.040 | 107.139 |
| 15 | 265.633 | 291.440 | -40.552 | 102.705 |
| 16 | 264.719 | 264.109 | -41.356 | 75.408 |
| 17 | 283.591 | 264.744 | -22.521 | 76.112 |
| 18 | 282.956 | 293.370 | -23.270 | 104.694 |

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Calibrated Fiducial Coordinates of Frame LfEyRtSh

| Fid | X | Y |
|-----|----------|----------|
| 1 | -193.950 | 148.160 |
| 2 | -80.380 | 162.380 |
| 3 | 75.670 | 164.310 |
| 4 | 191.214 | 148.961 |
| 5 | -193.920 | -5.010 |
| 6 | 192.310 | -4.800 |
| 7 | -193.010 | -159.210 |
| 8 | -80.050 | -147.600 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | |
|----|---------|----------|
| 9 | 75.390 | -144.880 |
| 10 | 192.720 | -158.520 |

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Fiducial Measurements of Frame LfEyRtSh

| ID | Measured | |
|----|----------|---------|
| | X | Y |
| 2 | 215.011 | 356.464 |
| 3 | 370.840 | 356.108 |
| 4 | 486.004 | 339.065 |
| 5 | 99.162 | 190.627 |
| 6 | 484.683 | 185.598 |
| 8 | 210.871 | 46.711 |
| 9 | 366.039 | 47.523 |

8-Parameter Residuals of the Fiducial Coordinates

| Fid | X | Y |
|-------------|--------|--------|
| 2 | 0.015 | 0.041 |
| 3 | -0.079 | 0.004 |
| 4 | 0.045 | -0.040 |
| 5 | 0.039 | -0.015 |
| 6 | 0.008 | -0.003 |
| 8 | -0.043 | -0.048 |
| 9 | 0.015 | 0.060 |
| Rms | 0.041 | 0.037 |
| Rms (check) | 0.225 | 0.203 |

Transformation Parameters Are:

| | | | | |
|----------|-----------|-----------|-----------|----------|
| 1.001048 | -0.014627 | -290.4377 | -0.000005 | 0.000005 |
| 0.013654 | 1.000787 | -197.1577 | | |

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 Body Anthropometry for HRV # 00253

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Plate Coordinates for Frame LfEyRtSh

| ID | Measured | | Adjusted | |
|----------|----------|---------|----------|---------|
| | X | Y | X | Y |
| Origin | 206.248 | 200.685 | -86.914 | 6.502 |
| Rib_Lf | 266.852 | 203.327 | -26.289 | 9.976 |
| Rib_Rt | 212.268 | 198.171 | -80.854 | 4.068 |
| SpineTop | 280.289 | 209.982 | -12.931 | 16.823 |
| SpineBot | 284.277 | 201.066 | -8.808 | 7.952 |
| spine_bb | 317.627 | 217.221 | 24.357 | 24.583 |
| sternum | 185.445 | 127.076 | -106.689 | -67.469 |
| rt_shold | 291.948 | 104.546 | 0.287 | -88.623 |
| rneckT | 318.668 | 245.110 | 24.989 | 52.517 |
| rneckB | 318.414 | 177.368 | 25.734 | -15.313 |
| r1 | 297.764 | 306.019 | 3.162 | 113.169 |
| r2 | 298.221 | 274.447 | 4.082 | 81.590 |
| r3 | 318.338 | 273.583 | 24.238 | 81.008 |
| r4 | 315.824 | 301.981 | 21.302 | 109.385 |

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| | | | | |
|----|---------|---------|---------|---------|
| r5 | 281.203 | 303.606 | -13.380 | 110.520 |
| r6 | 279.832 | 272.872 | -14.305 | 79.756 |
| r7 | 298.552 | 271.907 | 4.450 | 79.053 |
| r8 | 298.247 | 301.117 | 3.717 | 108.272 |
| c1 | 386.156 | 299.517 | 91.784 | 107.917 |
| c2 | 386.080 | 274.701 | 92.081 | 83.079 |
| c3 | 403.809 | 271.602 | 109.895 | 80.226 |
| c4 | 402.768 | 296.977 | 108.468 | 105.610 |
| c5 | 366.217 | 297.815 | 71.834 | 105.931 |
| c6 | 365.455 | 272.847 | 71.444 | 80.933 |
| c7 | 383.794 | 270.104 | 89.860 | 78.444 |
| c8 | 383.388 | 295.427 | 89.072 | 103.785 |
| 11 | 372.212 | 313.487 | 77.604 | 121.698 |
| 12 | 373.050 | 282.194 | 78.913 | 90.395 |
| 13 | 391.566 | 280.873 | 97.486 | 89.334 |
| 14 | 390.525 | 310.591 | 95.994 | 119.061 |
| 15 | 352.222 | 310.744 | 57.622 | 118.669 |
| 16 | 350.647 | 280.873 | 56.489 | 88.757 |
| 17 | 370.586 | 278.663 | 76.497 | 86.827 |
| 18 | 369.875 | 308.204 | 75.342 | 116.378 |

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Calibrated Fiducial Coordinates of Frame RtEyRtSh

| Fid | X | Y |
|-----|----------|----------|
| 1 | -193.950 | 148.160 |
| 2 | -80.380 | 162.380 |
| 3 | 75.670 | 164.310 |
| 4 | 191.214 | 148.961 |
| 5 | -193.920 | -5.010 |
| 6 | 192.310 | -4.800 |
| 7 | -193.010 | -159.210 |
| 8 | -80.050 | -147.600 |
| 9 | 75.390 | -144.880 |
| 10 | 192.720 | -158.520 |

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Fiducial Measurements of Frame RtEyRtSh

| ID | Measured | |
|----|----------|---------|
| | X | Y |
| 2 | 191.770 | 344.272 |
| 3 | 347.193 | 350.647 |
| 4 | 462.991 | 338.658 |
| 5 | 83.033 | 173.711 |
| 6 | 468.249 | 185.293 |
| 8 | 201.092 | 34.976 |
| 9 | 356.235 | 42.723 |

8-Parameter Residuals of the Fiducial Coordinates

| Fid | X | Y |
|-----|-------|--------|
| 2 | 0.153 | -0.009 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | |
|-------------|--------|--------|
| 3 | -0.121 | 0.034 |
| 4 | 0.091 | 0.077 |
| 5 | -0.028 | -0.026 |
| 6 | -0.100 | -0.192 |
| 8 | -0.111 | -0.032 |
| 9 | 0.175 | 0.148 |
| Rms | 0.133 | 0.098 |
| Rms (check) | 0.329 | 0.391 |

Transformation Parameters Are:
 0.999771 0.029486 -282.0947 -0.000010 0.000005
 -0.029919 1.000464 -176.3431

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Plate Coordinates for Frame RtEyRtSh

| ID | Measured | | Adjusted | |
|----------|----------|---------|----------|---------|
| | X | Y | X | Y |
| Origin | 134.137 | 188.671 | -142.475 | 8.405 |
| Rib_Lf | 189.611 | 189.611 | -87.014 | 7.690 |
| Rib_Rt | 139.954 | 183.007 | -136.836 | 2.563 |
| SpineTop | 201.752 | 197.358 | -74.642 | 15.085 |
| SpineBot | 212.700 | 189.738 | -63.920 | 7.127 |
| spine_bb | 249.682 | 207.696 | -26.382 | 24.012 |
| sternum | 114.097 | 111.735 | -164.820 | -68.008 |
| rt_shold | 241.376 | 95.606 | -38.026 | -88.080 |
| lneckT | 448.894 | 258.318 | 174.851 | 68.876 |
| lneckB | 448.818 | 175.539 | 172.400 | -14.200 |
| rneckT | 260.883 | 236.753 | -14.309 | 52.786 |
| rneckB | 263.627 | 169.037 | -13.568 | -15.141 |
| r1 | 227.457 | 294.919 | -46.027 | 111.989 |
| r2 | 229.667 | 263.982 | -44.737 | 80.963 |
| r3 | 250.800 | 263.601 | -23.606 | 79.966 |
| r4 | 246.786 | 292.125 | -26.776 | 108.635 |
| r5 | 212.242 | 291.821 | -61.332 | 109.327 |
| r6 | 212.979 | 260.680 | -61.525 | 78.145 |
| r7 | 232.385 | 260.985 | -42.108 | 77.884 |
| r8 | 230.302 | 290.373 | -43.317 | 107.357 |
| c1 | 316.713 | 292.735 | 43.246 | 107.224 |
| c2 | 317.805 | 267.614 | 43.604 | 82.030 |
| c3 | 336.829 | 266.040 | 62.624 | 79.897 |
| c4 | 334.467 | 291.490 | 61.000 | 105.464 |
| c5 | 297.713 | 290.195 | 24.142 | 105.230 |
| c6 | 298.577 | 265.405 | 24.278 | 80.378 |
| c7 | 317.475 | 263.322 | 43.148 | 77.740 |
| c8 | 316.078 | 288.442 | 42.484 | 102.944 |
| 11 | 296.748 | 306.095 | 23.643 | 121.179 |
| 12 | 299.364 | 275.488 | 25.363 | 90.454 |
| 13 | 318.973 | 274.803 | 44.986 | 89.197 |
| 14 | 316.332 | 304.038 | 43.196 | 118.555 |
| 15 | 278.155 | 302.997 | 4.937 | 118.612 |
| 16 | 278.790 | 272.745 | 4.680 | 88.306 |
| 17 | 299.568 | 271.653 | 25.454 | 86.607 |
| 18 | 297.002 | 300.330 | 23.728 | 115.399 |

Body Anthropometry Image Data File

| | | | | |
|-----------|-----------|----------|-------|----------------|
| LfEyLfSh | -838.200 | 1.000 | 1.000 | |
| Origin | 118.7074 | 14.0804 | | Photo LfEyLfSh |
| Rib_Lf | 118.3758 | 3.5684 | | Photo LfEyLfSh |
| *Rib_Rt | 69.3593 | 24.9248 | | Photo LfEyLfSh |
| SpineTop | 32.0426 | 17.8235 | | Photo LfEyLfSh |
| SpineBot | 28.0431 | 7.9459 | | Photo LfEyLfSh |
| spine_bb | 2.7075 | 15.5963 | | Photo LfEyLfSh |
| sternum | 130.4842 | -81.4432 | | Photo LfEyLfSh |
| *lf_shold | 29.7763 | -90.6093 | | Photo LfEyLfSh |
| lneckT | 10.0286 | 50.8605 | | Photo LfEyLfSh |
| lneckB | 7.7974 | -16.5859 | | Photo LfEyLfSh |
| rneckT | -180.0564 | 61.5182 | | Photo LfEyLfSh |
| rneckB | -181.5693 | -20.5057 | | Photo LfEyLfSh |
| *r1 | -65.1966 | 103.1791 | | Photo LfEyLfSh |
| r2 | -64.5895 | 77.2160 | | Photo LfEyLfSh |
| r3 | -56.5392 | 80.2299 | | Photo LfEyLfSh |
| r4 | -55.0858 | 115.3023 | | Photo LfEyLfSh |
| *r5 | -44.4719 | 100.5526 | | Photo LfEyLfSh |
| r6 | -43.7825 | 75.0169 | | Photo LfEyLfSh |
| r7 | -32.1149 | 78.8540 | | Photo LfEyLfSh |
| r8 | -31.6877 | 113.1492 | | Photo LfEyLfSh |
| c1 | -80.6856 | 100.9327 | | Photo LfEyLfSh |
| c2 | -81.4819 | 74.4441 | | Photo LfEyLfSh |
| *c3 | -75.0687 | 80.1321 | | Photo LfEyLfSh |
| *c4 | -72.8086 | 113.5465 | | Photo LfEyLfSh |
| *c5 | -61.0782 | 99.1489 | | Photo LfEyLfSh |
| *c6 | -61.1016 | 73.8980 | | Photo LfEyLfSh |
| c7 | -50.4732 | 78.6031 | | Photo LfEyLfSh |
| c8 | -50.5188 | 109.6709 | | Photo LfEyLfSh |
| l1 | 5.8712 | 104.0517 | | Photo LfEyLfSh |
| l2 | 5.1286 | 75.7192 | | Photo LfEyLfSh |
| l3 | 24.5773 | 77.4904 | | Photo LfEyLfSh |
| l4 | 26.0571 | 106.3056 | | Photo LfEyLfSh |
| l5 | 24.5327 | 102.0173 | | Photo LfEyLfSh |
| l6 | 24.0535 | 74.7473 | | Photo LfEyLfSh |
| l7 | 44.5187 | 75.3447 | | Photo LfEyLfSh |
| l8 | 43.4507 | 104.2003 | | Photo LfEyLfSh |
| ***** | | | | |
| RtEyLfSh | -838.200 | 1.000 | 1.000 | |
| Origin | 35.1290 | 8.4642 | | Photo RtEyLfSh |
| Rib_Lf | 36.1826 | -1.2707 | | Photo RtEyLfSh |
| Rib_Rt | -12.8694 | 21.0015 | | Photo RtEyLfSh |
| SpineTop | -37.9129 | 19.6061 | | Photo RtEyLfSh |
| SpineBot | -42.6158 | 9.7926 | | Photo RtEyLfSh |
| spine_bb | -67.8802 | 16.8707 | | Photo RtEyLfSh |
| sternum | 46.1639 | -80.7238 | | Photo RtEyLfSh |
| *lf_shold | -28.3954 | -90.2614 | | Photo RtEyLfSh |
| lneckT | -48.0064 | 51.6873 | | Photo RtEyLfSh |
| lneckB | -50.7060 | -15.7700 | | Photo RtEyLfSh |
| *r1 | -130.9705 | 104.1113 | | Photo RtEyLfSh |
| *r2 | -130.3634 | 78.0729 | | Photo RtEyLfSh |
| *r3 | -130.0745 | 82.1858 | | Photo RtEyLfSh |
| *r4 | -128.2289 | 117.3177 | | Photo RtEyLfSh |
| *r5 | -108.5759 | 101.5004 | | Photo RtEyLfSh |
| *r6 | -107.9208 | 76.4045 | | Photo RtEyLfSh |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|-----------|-----------|----------|----------------|----------------|
| r7 | -104.5107 | 80.4776 | Photo RtEyLfSh | |
| r8 | -103.4005 | 114.9166 | Photo RtEyLfSh | |
| c1 | -144.9755 | 102.1329 | Photo RtEyLfSh | |
| c2 | -145.6104 | 75.3767 | Photo RtEyLfSh | |
| *c3 | -146.6254 | 81.9221 | Photo RtEyLfSh | |
| *c4 | -144.7454 | 115.1035 | Photo RtEyLfSh | |
| *c5 | -124.1269 | 99.9733 | Photo RtEyLfSh | |
| *c6 | -124.0307 | 74.8475 | Photo RtEyLfSh | |
| *c7 | -120.7261 | 80.1389 | Photo RtEyLfSh | |
| *c8 | -120.8195 | 111.1259 | Photo RtEyLfSh | |
| 11 | -60.5933 | 105.0697 | Photo RtEyLfSh | |
| 12 | -61.5468 | 76.7790 | Photo RtEyLfSh | |
| 13 | -43.4213 | 78.3935 | Photo RtEyLfSh | |
| 14 | -42.0398 | 107.1388 | Photo RtEyLfSh | |
| 15 | -40.5516 | 102.7052 | Photo RtEyLfSh | |
| 16 | -41.3556 | 75.4077 | Photo RtEyLfSh | |
| 17 | -22.5213 | 76.1117 | Photo RtEyLfSh | |
| 18 | -23.2699 | 104.6938 | Photo RtEyLfSh | |
| ***** | | | | |
| LfEyRtSh | -838.200 | 1.000 | 1.000 | |
| Origin | -86.9139 | 6.5021 | | Photo LfEyRtSh |
| Rib_Lf | -26.2886 | 9.9762 | | Photo LfEyRtSh |
| Rib_Rt | -80.8540 | 4.0678 | | Photo LfEyRtSh |
| SpineTop | -12.9312 | 16.8226 | | Photo LfEyRtSh |
| SpineBot | -8.8019 | 7.9518 | | Photo LfEyRtSh |
| spine_bb | 24.3572 | 24.5835 | | Photo LfEyRtSh |
| sternum | -106.6885 | -67.4695 | | Photo LfEyRtSh |
| *rt_shold | 0.2868 | -88.6234 | | Photo LfEyRtSh |
| rneckT | 24.9890 | 52.5166 | | Photo LfEyRtSh |
| rneckB | 25.7339 | -15.3130 | | Photo LfEyRtSh |
| r1 | 3.1623 | 113.1687 | | Photo LfEyRtSh |
| r2 | 4.0824 | 81.5898 | | Photo LfEyRtSh |
| r3 | 24.2384 | 81.0082 | | Photo LfEyRtSh |
| r4 | 21.3020 | 109.3849 | | Photo LfEyRtSh |
| r5 | -13.3797 | 110.5201 | | Photo LfEyRtSh |
| r6 | -14.3051 | 79.7559 | | Photo LfEyRtSh |
| r7 | 4.4502 | 79.0529 | | Photo LfEyRtSh |
| r8 | 3.7172 | 108.2719 | | Photo LfEyRtSh |
| c1 | 91.7840 | 107.9168 | | Photo LfEyRtSh |
| c2 | 92.0813 | 83.0785 | | Photo LfEyRtSh |
| c3 | 109.8955 | 80.2257 | | Photo LfEyRtSh |
| c4 | 108.4676 | 105.6101 | | Photo LfEyRtSh |
| c5 | 71.8336 | 105.9312 | | Photo LfEyRtSh |
| c6 | 71.4438 | 80.9328 | | Photo LfEyRtSh |
| c7 | 89.8598 | 78.4445 | | Photo LfEyRtSh |
| c8 | 89.0715 | 103.7850 | | Photo LfEyRtSh |
| 11 | 77.6038 | 121.6977 | | Photo LfEyRtSh |
| 12 | 78.9127 | 90.3949 | | Photo LfEyRtSh |
| 13 | 97.4861 | 89.3339 | | Photo LfEyRtSh |
| 14 | 95.9944 | 119.0610 | | Photo LfEyRtSh |
| 15 | 57.6219 | 118.6686 | | Photo LfEyRtSh |
| 16 | 56.4894 | 88.7575 | | Photo LfEyRtSh |
| 17 | 76.4972 | 86.8266 | | Photo LfEyRtSh |
| 18 | 75.3420 | 116.3782 | | Photo LfEyRtSh |
| ***** | | | | |
| RtEyRtSh | -838.200 | 1.000 | 1.000 | |
| Origin | -142.4749 | 8.4053 | | Photo RtEyRtSh |
| Rib_Lf | -87.0137 | 7.6897 | | Photo RtEyRtSh |
| Rib_Rt | -136.8364 | 2.5626 | | Photo RtEyRtSh |

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| | | | |
|-----------|-----------|----------|----------------|
| SpineTop | -74.6417 | 15.0848 | Photo RtEyRtSh |
| SpineBot | -63.9205 | 7.1271 | Photo RtEyRtSh |
| spine_bb | -26.3823 | 24.0121 | Photo RtEyRtSh |
| sternum | -164.8196 | -68.0076 | Photo RtEyRtSh |
| *rt_shold | -38.0261 | -88.0801 | Photo RtEyRtSh |
| lneckT | 174.8515 | 68.8762 | Photo RtEyRtSh |
| lneckB | 172.3995 | -14.2002 | Photo RtEyRtSh |
| rneckT | -14.3094 | 52.7858 | Photo RtEyRtSh |
| rneckB | -13.5676 | -15.1412 | Photo RtEyRtSh |
| r1 | -46.0271 | 111.9888 | Photo RtEyRtSh |
| r2 | -44.7371 | 80.9632 | Photo RtEyRtSh |
| r3 | -23.6062 | 79.9656 | Photo RtEyRtSh |
| r4 | -26.7760 | 108.6349 | Photo RtEyRtSh |
| r5 | -61.3325 | 109.3273 | Photo RtEyRtSh |
| r6 | -61.5246 | 78.1450 | Photo RtEyRtSh |
| r7 | -42.1077 | 77.8838 | Photo RtEyRtSh |
| r8 | -43.3173 | 107.3571 | Photo RtEyRtSh |
| c1 | 43.2465 | 107.2244 | Photo RtEyRtSh |
| c2 | 43.6043 | 82.0303 | Photo RtEyRtSh |
| c3 | 62.6235 | 79.8974 | Photo RtEyRtSh |
| c4 | 60.9998 | 105.4642 | Photo RtEyRtSh |
| c5 | 24.1418 | 105.2303 | Photo RtEyRtSh |
| c6 | 24.2777 | 80.3777 | Photo RtEyRtSh |
| c7 | 43.1476 | 77.7396 | Photo RtEyRtSh |
| c8 | 42.4845 | 102.9435 | Photo RtEyRtSh |
| 11 | 23.6428 | 121.1788 | Photo RtEyRtSh |
| 12 | 25.3629 | 90.4545 | Photo RtEyRtSh |
| 13 | 44.9857 | 89.1972 | Photo RtEyRtSh |
| 14 | 43.1961 | 118.5550 | Photo RtEyRtSh |
| 15 | 4.9370 | 118.6117 | Photo RtEyRtSh |
| 16 | 4.6803 | 88.3057 | Photo RtEyRtSh |
| 17 | 25.4536 | 86.6072 | Photo RtEyRtSh |
| 18 | 23.7276 | 115.3987 | Photo RtEyRtSh |

Anthropometry and Initial Conditions Photogrammetric Program

Head Anthropometry Prep Printed Output

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Head Anthropometry for HRV # 00253

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Calibrated Fiducial Coordinates of Frame #1

| Fid | X | Y |
|-----|---------|---------|
| 1 | 18.113 | -12.126 |
| 2 | 18.105 | 12.126 |
| 3 | -18.120 | 12.131 |
| 4 | -18.105 | -12.126 |

Calibrated Focal Length = -55.003 mm. Xoff= -0.005 mm. Yoff= -0.022 mm.

Lens Distortion

Radial Parameters
K0=+0.19243120D-03 K1=-0.28396730D-05 K2=+0.19404160D-07
K3=-0.47157530D-10

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

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Fiducial Measurements of Frame #1

| ID | Measured | |
|----|----------|--------|
| | X | Y |
| 1 | 14.468 | 4.869 |
| 2 | 14.617 | 11.777 |
| 3 | 4.328 | 11.964 |
| 4 | 4.146 | 5.124 |

8-Parameter Residuals of the Fiducial Coordinates

| Fid | X | Y |
|-----|-------|-------|
| 1 | 0.000 | 0.000 |
| 2 | 0.000 | 0.000 |
| 3 | 0.000 | 0.000 |
| 4 | 0.000 | 0.000 |

| Rms | X | Y |
|-------------|-------|-------|
| Rms | 0.000 | 0.000 |
| Rms (check) | 0.047 | 0.071 |

Transformation Parameters Are:

| | | | | |
|----------|-----------|----------|----------|-----------|
| 3.528078 | -0.086591 | -32.3087 | 0.000957 | -0.000547 |
| 0.075706 | 3.542118 | -30.6039 | | |

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Plate Coordinates for Frame 1

| ID | Measured | | Adjusted | |
|-----------------|----------|--------|----------|---------|
| | X | Y | X | Y |
| Control: | | | | |
| a | 5.272 | 10.869 | -14.656 | 8.323 |
| j | 8.747 | 11.635 | -2.446 | 11.271 |
| k | 8.391 | 8.316 | -3.408 | -0.489 |
| rtc1 | 7.900 | 5.947 | -4.926 | -8.881 |
| rtc2 | 7.229 | 5.924 | -7.286 | -9.018 |
| rtc3 | 7.150 | 6.242 | -7.593 | -7.904 |
| rtc4 | 7.808 | 6.262 | -5.278 | -7.779 |
| rtc5 | 7.853 | 5.354 | -5.038 | -10.973 |
| rtc6 | 7.195 | 5.332 | -7.352 | -11.107 |
| Targets: | | | | |
| ear1-r | 10.607 | 7.388 | 4.452 | -3.588 |
| ear2-r | 10.491 | 7.619 | 4.027 | -2.784 |
| ear3-r | 10.382 | 7.843 | 3.626 | -2.004 |
| ear4-r | 10.263 | 8.067 | 3.190 | -1.224 |
| mrc1 | 11.455 | 7.861 | 7.381 | -1.858 |
| mrc2 | 11.221 | 7.963 | 6.554 | -1.517 |
| mrc3 | 11.150 | 8.075 | 6.296 | -1.128 |
| mrc4 | 11.344 | 7.971 | 6.984 | -1.479 |
| mrc5 | 11.314 | 7.632 | 6.907 | -2.674 |
| mrc6 | 11.096 | 7.739 | 6.135 | -2.315 |
| mcc1 | 11.668 | 8.567 | 8.068 | 0.643 |
| mcc2 | 11.457 | 8.685 | 7.321 | 1.043 |
| mcc3 | 11.367 | 8.774 | 6.998 | 1.349 |
| mcc4 | 11.571 | 8.686 | 7.719 | 1.055 |
| mcc5 | 11.533 | 8.351 | 7.614 | -0.128 |

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Head Anthropometry for HRV # 00253

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Calibrated Fiducial Coordinates of Frame #2

| Fid | X | Y |
|-----|---------|---------|
| 1 | 18.116 | -12.132 |
| 2 | 18.119 | 12.136 |
| 3 | -18.126 | 12.139 |
| 4 | -18.112 | -12.132 |

Calibrated Focal Length = -55.003 mm. Xoff= +0.027 mm. Yoff= +0.088 mm.

Lens Distortion

Radial Parameters
K0=+0.64679230D-03 K1=-0.13013980D-04 K2=+0.76994240D-07
K3=-0.14139510D-09

Anthropometry and Initial Conditions Photogrammetric Program

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

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Fiducial Measurements of Frame #2

| ID | Measured | Y |
|----|----------|--------|
| | X | |
| 1 | 14.584 | 4.916 |
| 2 | 14.637 | 11.765 |
| 3 | 4.488 | 11.838 |
| 4 | 4.260 | 5.003 |

8-Parameter Residuals of the Fiducial Coordinates

| Fid | X | Y |
|-------------|-------|-------|
| 1 | 0.000 | 0.000 |
| 2 | 0.000 | 0.000 |
| 3 | 0.000 | 0.000 |
| 4 | 0.000 | 0.000 |
| Rms | 0.000 | 0.000 |
| Rms (check) | 0.193 | 0.076 |

Transformation Parameters Are:

| | | | | |
|----------|-----------|----------|----------|-----------|
| 3.470361 | -0.072014 | -32.3217 | 0.000165 | -0.002513 |
| 0.026816 | 3.477392 | -29.4981 | | |

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Head Anthropometry for HRV # 00253

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Plate Coordinates for Frame 2

| ID | Measured | Adjusted | | |
|-----------------|----------|----------|---------|--------|
| | X | Y | X | Y |
| Control: | | | | |
| a | 6.106 | 10.643 | -12.239 | 7.790 |
| b | 6.999 | 10.754 | -9.067 | 8.212 |
| c | 6.227 | 7.958 | -11.529 | -1.778 |
| d | 7.053 | 8.318 | -8.642 | -0.480 |
| j | 13.249 | 10.696 | 13.186 | 8.167 |
| rtc1 | 6.568 | 6.787 | -10.206 | -5.901 |
| rtc2 | 6.148 | 6.883 | -11.698 | -5.575 |
| rtc3 | 6.472 | 7.050 | -10.571 | -4.978 |
| rtc4 | 6.878 | 6.946 | -9.128 | -5.333 |
| rtc5 | 6.598 | 6.307 | -10.053 | -7.588 |
| rtc6 | 6.171 | 6.402 | -11.568 | -7.266 |
| rtc8 | 6.890 | 6.465 | -9.039 | -7.024 |
| cen1 | 8.116 | 9.802 | -5.006 | 4.882 |
| cen3 | 8.045 | 9.912 | -5.268 | 5.224 |
| cen4 | 8.359 | 9.860 | -4.147 | 5.046 |
| cen5 | 8.124 | 7.388 | -4.942 | 3.355 |
| cen8 | 8.349 | 7.461 | -4.150 | 3.622 |
| lfc5 | 8.813 | 7.497 | -2.513 | 4.120 |
| lfc6 | 8.508 | 7.650 | -3.600 | 4.300 |
| Targets: | | | | |
| ron | 10.424 | 8.389 | 3.288 | -0.136 |

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| | | | | |
|--------|--------|-------|--------|--------|
| ear1-r | 9.135 | 7.384 | -1.199 | -3.728 |
| ear2-r | 9.211 | 7.569 | -0.945 | -3.073 |
| ear3-r | 9.293 | 7.762 | -0.669 | -2.388 |
| ear4-r | 9.366 | 7.952 | -0.426 | -1.714 |
| mrc1 | 10.887 | 7.458 | 4.982 | -3.417 |
| mrc2 | 10.661 | 7.592 | 4.176 | -2.950 |
| mrc3 | 10.780 | 7.682 | 4.591 | -2.629 |
| mrc5 | 10.778 | 7.251 | 4.610 | -4.150 |
| mrc6 | 10.570 | 7.411 | 3.866 | -3.592 |
| mrc8 | 10.885 | 7.314 | 4.984 | -3.925 |
| mcc1 | 11.335 | 8.064 | 6.529 | -1.262 |
| mcc2 | 11.119 | 8.197 | 5.758 | -0.797 |
| mcc3 | 11.224 | 8.297 | 6.124 | -0.440 |
| mcc4 | 11.422 | 8.149 | 6.832 | -0.959 |
| mcc5 | 11.228 | 7.874 | 6.162 | -1.938 |

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Calibrated Fiducial Coordinates of Frame #3

| Fid | X | Y |
|-----|---------|---------|
| 1 | 18.108 | -12.122 |
| 2 | 18.110 | 12.124 |
| 3 | -18.117 | 12.128 |
| 4 | -18.107 | -12.122 |

Calibrated Focal Length = -55.005 mm. Xoff= +0.037 mm. Yoff= +0.088 mm.

Lens Distortion

Radial Parameters

K0=+0.59205760D-03 K1=-0.11202800D-04 K2=+0.68771330D-07
K3=-0.13585810D-09

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Fiducial Measurements of Frame #3

| ID | Measured | |
|----|----------|--------|
| | X | Y |
| 1 | 14.050 | 5.175 |
| 2 | 14.005 | 12.034 |
| 3 | 3.751 | 12.032 |
| 4 | 3.735 | 5.174 |

8-Parameter Residuals of the Fiducial Coordinates

Fid **X** **Y**

Anthropometry and Initial Conditions Photogrammetric Program

| | | |
|-------------|-------|-------|
| 1 | 0.000 | 0.000 |
| 2 | 0.000 | 0.000 |
| 3 | 0.000 | 0.000 |
| 4 | 0.000 | 0.000 |
| Rms | 0.000 | 0.000 |
| Rms (check) | 0.062 | 0.033 |

Transformation Parameters Are:
 3.495096 0.006482 -31.1107 0.000017 -0.000903
 -0.000593 3.508391 -30.2153

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Plate Coordinates for Frame 3

| ID | Measured | | Adjusted | |
|-----------------|----------|--------|----------|--------|
| | X | Y | X | Y |
| Control: | | | | |
| a | 8.308 | 10.640 | -2.061 | 7.090 |
| b | 9.649 | 10.596 | 2.671 | 6.933 |
| c | 8.229 | 7.972 | -2.352 | -2.356 |
| g | 4.971 | 10.697 | -13.836 | 7.294 |
| h | 10.930 | 10.803 | 7.193 | 7.666 |
| rtc1 | 6.891 | 6.921 | -7.062 | -6.063 |
| rtc2 | 6.810 | 7.107 | -7.347 | -5.407 |
| rtc3 | 7.280 | 7.147 | -5.694 | -5.267 |
| rtc4 | 7.388 | 6.963 | -5.314 | -5.915 |
| rtc5 | 6.891 | 6.452 | -7.061 | -7.715 |
| rtc6 | 6.774 | 6.624 | -7.473 | -7.109 |
| rtc8 | 7.379 | 6.465 | -5.346 | -7.670 |
| cen1 | 10.718 | 9.405 | 6.429 | 2.711 |
| lfc1 | 12.009 | 9.436 | 10.978 | 2.819 |
| lfc2 | 11.820 | 9.541 | 10.313 | 3.191 |
| lfc3 | 12.195 | 9.550 | 11.635 | 3.223 |
| lfc4 | 12.418 | 9.438 | 12.419 | 2.826 |
| lfc5 | 11.974 | 9.000 | 10.847 | 1.276 |
| lfc6 | 11.779 | 9.085 | 10.162 | 1.577 |
| lfc8 | 12.378 | 9.000 | 12.270 | 1.276 |
| Targets: | | | | |
| ron | 10.367 | 7.535 | 5.171 | -3.900 |
| lon | 11.091 | 7.593 | 7.718 | -3.695 |
| ear1-r | 8.442 | 6.876 | -1.607 | -6.223 |
| ear2-r | 8.680 | 7.032 | -0.769 | -5.674 |
| ear3-r | 8.922 | 7.201 | 0.083 | -5.078 |
| ear4-r | 9.159 | 7.365 | 0.918 | -4.500 |
| ear1-l | 12.246 | 7.044 | 11.772 | -5.632 |
| ear2-l | 12.002 | 7.183 | 10.916 | -5.141 |
| ear3-l | 11.758 | 7.308 | 10.060 | -4.700 |
| ear4-l | 11.520 | 7.440 | 9.225 | -4.235 |
| mrc1 | 10.385 | 6.342 | 5.219 | -8.104 |
| mrc2 | 10.280 | 6.565 | 4.853 | -7.319 |
| mrc5 | 10.322 | 6.138 | 4.996 | -8.822 |
| mrc6 | 10.201 | 6.353 | 4.573 | -8.065 |

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| | | | | |
|------|--------|-------|-------|--------|
| mrc8 | 10.600 | 6.158 | 5.973 | -8.752 |
| mcc1 | 11.018 | 6.896 | 7.452 | -6.153 |
| mcc2 | 10.888 | 7.138 | 6.998 | -5.300 |
| mcc3 | 11.182 | 7.172 | 8.032 | -5.180 |
| mcc4 | 11.293 | 6.925 | 8.419 | -6.051 |
| mcc5 | 10.956 | 6.684 | 7.231 | -6.900 |
| mcc6 | 10.823 | 6.922 | 6.766 | -6.061 |
| mcc8 | 11.223 | 6.721 | 8.170 | -6.769 |
| mlc3 | 11.456 | 6.726 | 8.989 | -6.752 |
| mlc4 | 11.567 | 6.499 | 9.376 | -7.551 |
| mlc5 | 11.234 | 6.242 | 8.202 | -8.456 |
| mlc8 | 11.500 | 6.289 | 9.137 | -8.291 |

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Calibrated Fiducial Coordinates of Frame

#4

| Fid | X | Y |
|-----|---------|---------|
| 1 | 18.102 | -12.127 |
| 2 | 18.110 | 12.118 |
| 3 | -18.109 | 12.132 |
| 4 | -18.124 | -12.127 |

Calibrated Focal Length = -55.004 mm. Xoff= -0.056 mm. Yoff= +0.132 mm.

Lens Distortion

Radial Parameters
 K0=+0.72422290D-03 K1=-0.13957730D-04 K2=+0.81529700D-07
 K3=-0.14888030D-09

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Fiducial Measurements of Frame

#4

| ID | Measured | |
|----|----------|--------|
| | X | Y |
| 1 | 14.080 | 5.698 |
| 2 | 14.062 | 12.516 |
| 3 | 3.849 | 12.604 |
| 4 | 3.790 | 5.714 |

8-Parameter Residuals of the Fiducial Coordinates

| Fid | X | Y |
|-----|-------|-------|
| 1 | 0.000 | 0.000 |
| 2 | 0.000 | 0.000 |
| 3 | 0.000 | 0.000 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|--------------------------------|-----------|----------|-----------|-----------|
| 4 | 0.000 | 0.000 | | |
| Rms | 0.000 | 0.000 | | |
| Rms (check) | 0.069 | 0.062 | | |
| Transformation Parameters Are: | | | | |
| 3.469922 | -0.008782 | -31.0518 | -0.000952 | -0.001033 |
| 0.017154 | 3.474843 | -31.9335 | | |

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Plate Coordinates for Frame 4

| ID | Measured | | Adjusted | |
|-----------------|----------|--------|----------|--------|
| | X | Y | X | Y |
| Control: | | | | |
| a | 7.756 | 11.858 | -4.272 | 9.460 |
| b | 9.236 | 11.789 | 0.968 | 9.255 |
| d | 9.252 | 9.104 | 1.047 | -0.275 |
| f | 11.288 | 6.956 | 8.258 | -7.839 |
| g | 6.416 | 11.952 | -9.005 | 9.758 |
| h | 12.793 | 12.006 | 13.622 | 10.124 |
| rtc1 | 5.687 | 8.169 | -11.494 | -3.630 |
| rtc2 | 5.827 | 8.368 | -11.007 | -2.928 |
| rtc3 | 6.311 | 8.362 | -9.308 | -2.942 |
| rtc4 | 6.205 | 8.169 | -9.676 | -3.623 |
| rtc5 | 5.739 | 7.680 | -11.301 | -5.350 |
| rtc8 | 6.238 | 7.679 | -9.551 | -5.347 |
| cen1 | 10.165 | 10.474 | 4.272 | 4.603 |
| cen2 | 10.180 | 10.605 | 4.324 | 5.068 |
| cen3 | 10.679 | 10.590 | 6.095 | 5.026 |
| cen4 | 10.675 | 10.474 | 6.081 | 4.613 |
| cen5 | 10.149 | 9.978 | 4.218 | 2.841 |
| cen8 | 10.660 | 9.961 | 6.030 | 2.791 |
| lfc1 | 11.720 | 10.457 | 9.793 | 4.575 |
| lfc2 | 11.685 | 10.567 | 9.669 | 4.966 |
| lfc3 | 12.179 | 10.572 | 11.427 | 4.995 |
| lfc4 | 12.245 | 10.443 | 11.662 | 4.537 |
| lfc5 | 11.701 | 9.959 | 9.725 | 2.804 |
| lfc8 | 12.218 | 9.945 | 11.564 | 2.765 |
| Targets: | | | | |
| ron | 7.549 | 8.508 | -4.958 | -2.409 |
| lon | 8.415 | 8.504 | -1.905 | -2.411 |
| ear1-r | 5.942 | 7.989 | -10.595 | -4.260 |
| ear2-r | 6.214 | 8.143 | -9.644 | -3.715 |
| ear3-r | 6.479 | 8.278 | -8.716 | -3.235 |
| ear4-r | 6.754 | 8.424 | -7.753 | -2.717 |
| ear1-l | 10.218 | 7.780 | 4.471 | -4.943 |
| ear2-l | 9.953 | 7.954 | 3.533 | -4.332 |
| ear3-l | 9.693 | 8.117 | 2.613 | -3.760 |
| ear4-l | 9.434 | 8.291 | 1.696 | -3.148 |
| mrc1 | 7.225 | 7.253 | -6.078 | -6.835 |
| mrc2 | 7.252 | 7.500 | -5.987 | -5.966 |
| mrc5 | 7.260 | 7.044 | -5.951 | -7.570 |
| mrc8 | 7.576 | 7.038 | -4.841 | -7.588 |
| mcc1 | 7.645 | 7.781 | -4.609 | -4.972 |

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| | | | | |
|------|-------|-------|--------|--------|
| mcc2 | 7.658 | 8.033 | -4.567 | -4.084 |
| mcc3 | 8.003 | 8.046 | -3.352 | -4.033 |
| mcc4 | 7.985 | 7.789 | -3.412 | -4.940 |
| mcc5 | 7.687 | 7.561 | -4.458 | -5.746 |
| mcc7 | 8.042 | 7.821 | -3.212 | -4.826 |
| mcc8 | 8.027 | 7.568 | -3.261 | -5.718 |
| mlc1 | 8.281 | 7.251 | -2.363 | -6.832 |
| mlc3 | 8.621 | 7.531 | -1.168 | -5.842 |
| mlc4 | 8.610 | 7.274 | -1.204 | -6.747 |
| mlc5 | 8.314 | 7.056 | -2.244 | -7.518 |
| mlc7 | 8.662 | 7.309 | -1.021 | -6.623 |
| mlc8 | 8.636 | 7.066 | -1.110 | -7.479 |

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Calibrated Fiducial Coordinates of Frame #5

| Fid | X | Y |
|-----|---------|---------|
| 1 | 18.130 | -12.125 |
| 2 | 18.123 | 12.136 |
| 3 | -18.118 | 12.117 |
| 4 | -18.106 | -12.125 |

Calibrated Focal Length = -55.002 mm. Xoff= +0.013 mm. Yoff= +0.122 mm.

Lens Distortion

Radial Parameters
K0=+0.31260690D-03 K1=-0.76500290D-05 K2=+0.56783210D-07
K3=-0.12129480D-09

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Fiducial Measurements of Frame #5

| ID | Measured | |
|----|----------|--------|
| | X | Y |
| 1 | 14.162 | 5.077 |
| 2 | 14.136 | 11.949 |
| 3 | 3.842 | 11.871 |
| 4 | 3.869 | 5.051 |

8-Parameter Residuals of the Fiducial Coordinates

| | | |
|-----|-------|-------|
| Fid | X | Y |
| 1 | 0.000 | 0.000 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | |
|-------------|-------|-------|
| 2 | 0.000 | 0.000 |
| 3 | 0.000 | 0.000 |
| 4 | 0.000 | 0.000 |
| Rms | 0.000 | 0.000 |
| Rms (check) | 0.037 | 0.067 |

Transformation Parameters Are:
 3.541999 0.012342 -31.9213 0.000664 0.000018
 -0.017068 3.564324 -30.0959

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Plate Coordinates for Frame 5

| ID | Measured | | Adjusted | |
|-----------------|----------|--------|----------|--------|
| | X | Y | X | Y |
| Control: | | | | |
| b | 10.896 | 11.654 | 6.753 | 11.052 |
| c | 9.645 | 9.043 | 2.325 | 1.837 |
| d | 10.777 | 8.689 | 6.300 | 0.564 |
| f | 10.960 | 5.820 | 6.907 | -9.591 |
| cen1 | 11.029 | 10.034 | 7.200 | 5.318 |
| cen2 | 11.402 | 10.146 | 8.511 | 5.706 |
| cen3 | 11.867 | 10.024 | 10.141 | 5.265 |
| cen4 | 11.482 | 9.913 | 8.789 | 4.880 |
| cen5 | 10.991 | 9.488 | 7.060 | 3.387 |
| cen8 | 11.448 | 9.340 | 8.662 | 2.854 |
| lfc1 | 12.479 | 9.641 | 12.282 | 3.899 |
| lfc2 | 12.852 | 9.773 | 13.591 | 4.358 |
| lfc3 | 13.375 | 9.641 | 15.420 | 3.881 |
| lfc4 | 13.006 | 9.508 | 14.127 | 3.419 |
| lfc5 | 12.426 | 9.059 | 12.089 | 1.843 |
| lfc7 | 13.339 | 9.041 | 15.287 | 1.763 |
| lfc8 | 12.949 | 8.900 | 13.920 | 1.272 |
| Targets: | | | | |
| lon | 6.377 | 8.628 | -9.200 | 0.424 |
| ear1-r | 5.552 | 8.666 | -12.116 | 0.573 |
| ear2-r | 5.740 | 8.731 | -11.450 | 0.801 |
| ear1-l | 8.036 | 7.346 | -3.362 | -4.150 |
| ear2-l | 7.932 | 7.599 | -3.726 | -3.252 |
| ear3-l | 7.817 | 7.844 | -4.128 | -2.381 |
| ear4-l | 7.704 | 8.080 | -4.524 | -1.542 |
| mcc1 | 5.056 | 8.210 | -13.877 | -1.027 |
| mcc2 | 5.284 | 8.425 | -13.067 | -0.278 |
| mcc3 | 5.480 | 8.360 | -12.375 | -0.512 |
| mcc4 | 5.246 | 8.143 | -13.205 | -1.279 |
| mcc5 | 5.205 | 7.986 | -13.353 | -1.836 |
| mcc7 | 5.624 | 8.132 | -11.868 | -1.324 |
| mcc8 | 5.401 | 7.905 | -12.660 | -2.127 |
| mlc1 | 5.729 | 7.522 | -11.504 | -3.492 |
| mlc2 | 5.951 | 7.737 | -10.717 | -2.732 |
| mlc3 | 6.141 | 7.652 | -10.046 | -3.036 |
| mlc4 | 5.915 | 7.441 | -10.848 | -3.782 |

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|------|-------|-------|---------|--------|
| mlc5 | 5.878 | 7.290 | -10.980 | -4.317 |
| mlc7 | 6.295 | 7.441 | -9.505 | -3.787 |
| mlc8 | 6.065 | 7.232 | -10.320 | -4.526 |

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Calibrated Fiducial Coordinates of Frame #6

| Fid | X | Y |
|-----|---------|---------|
| 1 | 18.105 | -12.122 |
| 2 | 18.111 | 12.127 |
| 3 | -18.134 | 12.141 |
| 4 | -18.105 | -12.122 |

Calibrated Focal Length = -55.005 mm. Xoff= +0.045 mm. Yoff= +0.036 mm.

Lens Distortion

Radial Parameters
K0=+0.72083470D-03 K1=-0.13284430D-04 K2=+0.79422490D-07
K3=-0.15412240D-09

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Fiducial Measurements of Frame #6

| ID | Measured | | |
|----|----------|--------|--|
| | X | Y | |
| 1 | 13.479 | 5.731 | |
| 2 | 13.487 | 12.568 | |
| 3 | 3.246 | 12.600 | |
| 4 | 3.209 | 5.750 | |

8-Parameter Residuals of the Fiducial Coordinates

| | | | |
|-------------|-------|-------|--|
| Fid | X | Y | |
| 1 | 0.000 | 0.000 | |
| 2 | 0.000 | 0.000 | |
| 3 | 0.000 | 0.000 | |
| 4 | 0.000 | 0.000 | |
| Rms | 0.000 | 0.000 | |
| Rms (check) | 0.041 | 0.031 | |

Transformation Parameters Are:

| | | | | |
|----------|-----------|----------|-----------|-----------|
| 3.510959 | -0.013339 | -29.2288 | -0.000120 | -0.000549 |
| 0.008223 | 3.523136 | -32.3652 | | |

Anthropometry and Initial Conditions Photogrammetric Program

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Plate Coordinates for Frame 6

| ID | Measured | | Adjusted | |
|-----------------|----------|--------|----------|---------|
| | X | Y | X | Y |
| Control: | | | | |
| b | 13.038 | 11.118 | 16.473 | 6.927 |
| rtc1 | 9.827 | 8.701 | 5.145 | -1.676 |
| rtc2 | 10.437 | 8.651 | 7.300 | -1.848 |
| rtc3 | 10.409 | 8.388 | 7.204 | -2.780 |
| rtc4 | 9.790 | 8.438 | 5.017 | -2.608 |
| rtc7 | 10.374 | 7.818 | 7.085 | -4.799 |
| rtc8 | 9.805 | 7.870 | 5.076 | -4.620 |
| cen1 | 11.320 | 8.752 | 10.418 | -1.483 |
| cen2 | 12.234 | 8.677 | 13.649 | -1.741 |
| cen3 | 12.268 | 8.272 | 13.772 | -3.176 |
| cen4 | 11.303 | 8.351 | 10.361 | -2.904 |
| cen8 | 11.230 | 7.524 | 10.110 | -5.833 |
| lfc1 | 11.232 | 7.462 | 10.117 | -6.052 |
| lfc2 | 12.321 | 7.348 | 13.964 | -6.447 |
| lfc3 | 12.344 | 6.787 | 14.047 | -8.431 |
| lfc4 | 11.189 | 6.901 | 9.970 | -8.037 |
| lfc7 | 12.218 | 5.845 | 13.602 | -11.757 |
| lfc8 | 11.105 | 5.958 | 9.681 | -11.371 |
| Targets: | | | | |
| ear1-1 | 5.411 | 7.091 | -10.418 | -7.408 |
| ear2-1 | 5.617 | 7.410 | -9.697 | -6.278 |
| ear3-1 | 5.844 | 7.720 | -8.903 | -5.180 |
| ear4-1 | 6.036 | 8.018 | -8.231 | -4.124 |
| mcc1 | 4.382 | 9.228 | -14.091 | 0.147 |
| mcc2 | 4.661 | 9.350 | -13.108 | 0.582 |
| mcc3 | 4.576 | 9.210 | -13.406 | 0.085 |
| mcc4 | 4.255 | 9.093 | -14.536 | -0.332 |
| mcc8 | 4.422 | 8.786 | -13.940 | -1.418 |
| mlc1 | 4.577 | 8.270 | -13.382 | -3.244 |
| mlc3 | 4.767 | 8.247 | -12.712 | -3.323 |
| mlc4 | 4.464 | 8.125 | -13.778 | -3.758 |
| mlc7 | 4.943 | 7.941 | -12.085 | -4.405 |
| mlc8 | 4.630 | 7.807 | -13.186 | -4.882 |

Head Anthropometry Image Data File

| 5.87500 | | 5.81250 | | | |
|---------|----------|----------|---------|--------|----|
| #1 | -55.003 | 0.055 | 0.055 | #1-580 | |
| a | -14.6561 | 8.3229 | | Photo | #1 |
| j | -2.4462 | 11.2708 | | Photo | #1 |
| k | -3.4083 | -0.4887 | | Photo | #1 |
| rtc1 | -4.9258 | -8.8809 | | Photo | #1 |
| rtc2 | -7.2857 | -9.0182 | | Photo | #1 |
| rtc3 | -7.5927 | -7.9039 | | Photo | #1 |
| rtc4 | -5.2776 | -7.7789 | | Photo | #1 |
| rtc5 | -5.0384 | -10.9729 | | Photo | #1 |
| rtc6 | -7.3519 | -11.1068 | | Photo | #1 |
| ear1-r | 4.4523 | -3.5880 | | Photo | #1 |
| ear2-r | 4.0266 | -2.7841 | | Photo | #1 |
| ear3-r | 3.6258 | -2.0039 | | Photo | #1 |
| ear4-r | 3.1898 | -1.2241 | | Photo | #1 |
| mrc1 | 7.3812 | -1.8577 | | Photo | #1 |
| mrc2 | 6.5542 | -1.5168 | | Photo | #1 |
| mrc3 | 6.2965 | -1.1281 | | Photo | #1 |
| mrc4 | 6.9839 | -1.4792 | | Photo | #1 |
| mrc5 | 6.9068 | -2.6742 | | Photo | #1 |
| mrc6 | 6.1352 | -2.3147 | | Photo | #1 |
| mcc1 | 8.0685 | 0.6428 | | Photo | #1 |
| mcc2 | 7.3207 | 1.0425 | | Photo | #1 |
| mcc3 | 6.9984 | 1.3493 | | Photo | #1 |
| mcc4 | 7.7194 | 1.0545 | | Photo | #1 |
| mcc5 | 7.6139 | -0.1276 | | Photo | #1 |
| ***** | | | | | |
| #2 | -55.003 | 0.055 | 0.055 | #2-736 | |
| * | a | -12.2394 | 7.7903 | Photo | #2 |
| * | b | -9.0674 | 8.2118 | Photo | #2 |
| * | c | -11.5294 | -1.7780 | Photo | #2 |
| * | d | -8.6416 | -0.4798 | Photo | #2 |
| * | j | 13.1862 | 8.1672 | Photo | #2 |
| * | rtc1 | -10.2061 | -5.9014 | Photo | #2 |
| * | rtc2 | -11.6981 | -5.5755 | Photo | #2 |
| * | rtc3 | -10.5711 | -4.9781 | Photo | #2 |
| * | rtc4 | -9.1278 | -5.3331 | Photo | #2 |
| * | rtc5 | -10.0529 | -7.5876 | Photo | #2 |
| * | rtc6 | -11.5678 | -7.2664 | Photo | #2 |
| * | rtc8 | -9.0391 | -7.0244 | Photo | #2 |
| * | cen1 | -5.0059 | 4.8324 | Photo | #2 |
| * | cen3 | -5.2677 | 5.2235 | Photo | #2 |
| * | cen4 | -4.1473 | 5.0464 | Photo | #2 |
| * | cen5 | -4.9422 | 3.3550 | Photo | #2 |
| * | cen8 | -4.1495 | 3.6216 | Photo | #2 |
| * | lfc5 | -2.5127 | 4.1197 | Photo | #2 |
| * | lfc6 | -3.6005 | 4.3004 | Photo | #2 |
| * | ron | 3.2881 | -0.1357 | Photo | #2 |
| * | ear1-r | -1.1992 | -3.7278 | Photo | #2 |
| * | ear2-r | -0.9448 | -3.0725 | Photo | #2 |
| * | ear3-r | -0.6695 | -2.3880 | Photo | #2 |
| * | ear4-r | -0.4255 | -1.7137 | Photo | #2 |
| * | mrc1 | 4.9823 | -3.4171 | Photo | #2 |
| * | mrc2 | 4.1764 | -2.9505 | Photo | #2 |
| * | mrc3 | 4.5911 | -2.6291 | Photo | #2 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|--------|----------|---------|-------|--------|
| mrc5 | 4.6101 | -4.1503 | Photo | #2 |
| mrc6 | 3.8664 | -3.5920 | Photo | #2 |
| mrc8 | 4.9838 | -3.9251 | Photo | #2 |
| mcc1 | 6.5291 | -1.2623 | Photo | #2 |
| mcc2 | 5.7582 | -0.7973 | Photo | #2 |
| mcc3 | 6.1236 | -0.4400 | Photo | #2 |
| mcc4 | 6.8317 | -0.9589 | Photo | #2 |
| mcc5 | 6.1619 | -1.9376 | Photo | #2 |
| ***** | | | | |
| #3 | -55.005 | 0.055 | 0.055 | #3-674 |
| a | -2.0609 | 7.0902 | Photo | #3 |
| b | 2.6711 | 6.9331 | Photo | #3 |
| c | -2.3523 | -2.3564 | Photo | #3 |
| * g | -13.8361 | 7.2936 | Photo | #3 |
| * h | 7.1930 | 7.6657 | Photo | #3 |
| rtc1 | -7.0615 | -6.0627 | Photo | #3 |
| rtc2 | -7.3465 | -5.4070 | Photo | #3 |
| rtc3 | -5.6936 | -5.2666 | Photo | #3 |
| rtc4 | -5.3140 | -5.9154 | Photo | #3 |
| rtc5 | -7.0613 | -7.7149 | Photo | #3 |
| rtc6 | -7.4727 | -7.1090 | Photo | #3 |
| rtc8 | -5.3460 | -7.6696 | Photo | #3 |
| cen1 | 6.4287 | 2.7106 | Photo | #3 |
| lfc1 | 10.9777 | 2.8190 | Photo | #3 |
| lfc2 | 10.3134 | 3.1909 | Photo | #3 |
| lfc3 | 11.6352 | 3.2225 | Photo | #3 |
| lfc4 | 12.4192 | 2.8258 | Photo | #3 |
| lfc5 | 10.8473 | 1.2760 | Photo | #3 |
| lfc6 | 10.1618 | 1.5768 | Photo | #3 |
| lfc8 | 12.2705 | 1.2757 | Photo | #3 |
| ron | 5.1706 | -3.8999 | Photo | #3 |
| lon | 7.7181 | -3.6950 | Photo | #3 |
| ear1-r | -1.6074 | -6.2233 | Photo | #3 |
| ear2-r | -0.7694 | -5.6737 | Photo | #3 |
| ear3-r | 0.0830 | -5.0781 | Photo | #3 |
| ear4-r | 0.9182 | -4.4998 | Photo | #3 |
| ear1-l | 11.7717 | -5.6316 | Photo | #3 |
| ear2-l | 10.9159 | -5.1414 | Photo | #3 |
| ear3-l | 10.0597 | -4.7005 | Photo | #3 |
| ear4-l | 9.2247 | -4.2348 | Photo | #3 |
| mrc1 | 5.2194 | -8.1040 | Photo | #3 |
| mrc2 | 4.8530 | -7.3189 | Photo | #3 |
| mrc5 | 4.9956 | -8.8219 | Photo | #3 |
| mrc6 | 4.5729 | -8.0653 | Photo | #3 |
| mrc8 | 5.9727 | -8.7516 | Photo | #3 |
| mcc1 | 7.4515 | -6.1528 | Photo | #3 |
| mcc2 | 6.9978 | -5.2999 | Photo | #3 |
| mcc3 | 8.0320 | -5.1799 | Photo | #3 |
| mcc4 | 8.4187 | -6.0506 | Photo | #3 |
| mcc5 | 7.2306 | -6.8997 | Photo | #3 |
| mcc6 | 6.7663 | -6.0612 | Photo | #3 |
| mcc8 | 8.1697 | -6.7694 | Photo | #3 |
| mlc3 | 8.9888 | -6.7518 | Photo | #3 |
| mlc4 | 9.3756 | -7.5514 | Photo | #3 |
| mlc5 | 1.2016 | -8.4561 | Photo | #3 |
| mlc8 | 1.1370 | -8.2908 | Photo | #3 |
| ***** | | | | |
| #4 | -55.004 | 0.055 | 0.055 | #4-623 |
| a | -4.2721 | 9.4603 | Photo | #4 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | | | | | |
|--------|----------|---------|---------|--------|----|
| b | 0.9680 | 9.2549 | Photo | #4 | |
| d | 1.0467 | -0.2746 | Photo | #4 | |
| f | 8.2583 | -7.8387 | Photo | #4 | |
| * | g | -9.0048 | 9.7582 | Photo | #4 |
| * | h | 13.6216 | 10.1241 | Photo | #4 |
| rtc1 | -11.4936 | -3.6303 | Photo | #4 | |
| rtc2 | -11.0066 | -2.9276 | Photo | #4 | |
| rtc3 | -9.3077 | -2.9418 | Photo | #4 | |
| rtc4 | -9.6761 | -3.6231 | Photo | #4 | |
| rtc5 | -11.3011 | -5.3500 | Photo | #4 | |
| rtc8 | -9.5508 | -5.3473 | Photo | #4 | |
| cen1 | 4.2716 | 4.6027 | Photo | #4 | |
| cen2 | 4.3240 | 5.0684 | Photo | #4 | |
| cen3 | 6.0947 | 5.0258 | Photo | #4 | |
| cen4 | 6.0809 | 4.6134 | Photo | #4 | |
| cen5 | 4.2176 | 2.8411 | Photo | #4 | |
| cen8 | 6.0296 | 2.7907 | Photo | #4 | |
| lfc1 | 9.7933 | 4.5752 | Photo | #4 | |
| lfc2 | 9.6689 | 4.9658 | Photo | #4 | |
| lfc3 | 11.4271 | 4.9947 | Photo | #4 | |
| lfc4 | 11.6617 | 4.5369 | Photo | #4 | |
| lfc5 | 9.7253 | 2.8040 | Photo | #4 | |
| lfc8 | 11.5639 | 2.7647 | Photo | #4 | |
| ron | -4.9580 | -2.4093 | Photo | #4 | |
| lon | -1.9052 | -2.4108 | Photo | #4 | |
| ear1-r | -10.5954 | -4.2603 | Photo | #4 | |
| ear2-r | -9.6440 | -3.7145 | Photo | #4 | |
| ear3-r | -8.7163 | -3.2354 | Photo | #4 | |
| ear4-r | -7.7529 | -2.7170 | Photo | #4 | |
| ear1-l | 4.4710 | -4.9426 | Photo | #4 | |
| ear2-l | 3.5332 | -4.3317 | Photo | #4 | |
| ear3-l | 2.6131 | -3.7595 | Photo | #4 | |
| ear4-l | 1.6963 | -3.1484 | Photo | #4 | |
| mrc1 | -6.0777 | -6.8351 | Photo | #4 | |
| mrc2 | -5.9869 | -5.9658 | Photo | #4 | |
| mrc5 | -5.9513 | -7.5698 | Photo | #4 | |
| mrc8 | -4.8406 | -7.5879 | Photo | #4 | |
| mcc1 | -4.6091 | -4.9719 | Photo | #4 | |
| mcc2 | -4.5671 | -4.0836 | Photo | #4 | |
| mcc3 | -3.3523 | -4.0334 | Photo | #4 | |
| mcc4 | -3.4122 | -4.9398 | Photo | #4 | |
| mcc5 | -4.4581 | -5.7464 | Photo | #4 | |
| mcc7 | -3.2119 | -4.8263 | Photo | #4 | |
| mcc8 | -3.2613 | -5.7180 | Photo | #4 | |
| mlc1 | -2.3627 | -6.8317 | Photo | #4 | |
| mlc3 | -1.1677 | -5.8417 | Photo | #4 | |
| mlc4 | -1.2037 | -6.7473 | Photo | #4 | |
| mlc5 | -2.2441 | -7.5177 | Photo | #4 | |
| mlc7 | -1.0208 | -6.6234 | Photo | #4 | |
| mlc8 | -1.1099 | -7.4794 | Photo | #4 | |
| <hr/> | | | | | |
| * | ***** | | | | |
| #5 | -55.002 | 0.055 | 0.055 | #5-591 | |
| b | 6.7533 | 11.0523 | Photo | #5 | |
| c | 2.3252 | 1.8373 | Photo | #5 | |
| d | 6.2996 | 0.5637 | Photo | #5 | |
| f | 6.9070 | -9.5909 | Photo | #5 | |
| cen1 | 7.2002 | 5.3176 | Photo | #5 | |
| cen2 | 8.5108 | 5.7060 | Photo | #5 | |
| cen3 | 10.1407 | 5.2651 | Photo | #5 | |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|--------------|----------|----------|----------|--------------|
| cen4 | 8.7887 | 4.8803 | Photo | #5 |
| cen5 | 7.0604 | 3.3868 | Photo | #5 |
| cen8 | 8.6625 | 2.8544 | Photo | #5 |
| lfc1 | 12.2821 | 3.8990 | Photo | #5 |
| lfc2 | 13.5909 | 4.3583 | Photo | #5 |
| lfc3 | 15.4201 | 3.8815 | Photo | #5 |
| lfc4 | 14.1271 | 3.4189 | Photo | #5 |
| lfc5 | 12.0891 | 1.8428 | Photo | #5 |
| lfc7 | 15.2873 | 1.7627 | Photo | #5 |
| lfc8 | 13.9201 | 1.2715 | Photo | #5 |
| lon | -9.2001 | 0.4239 | Photo | #5 |
| ear1-r | -12.1160 | 0.5732 | Photo | #5 |
| ear2-r | -11.4502 | 0.8006 | Photo | #5 |
| ear1-l | -3.3622 | -4.1501 | Photo | #5 |
| ear2-l | -3.7259 | -3.2516 | Photo | #5 |
| ear3-l | -4.1284 | -2.3811 | Photo | #5 |
| ear4-l | -4.5240 | -1.5424 | Photo | #5 |
| mcc1 | -13.8771 | -1.0273 | Photo | #5 |
| mcc2 | -13.0674 | -0.2781 | Photo | #5 |
| mcc3 | -12.3746 | -0.5122 | Photo | #5 |
| mcc4 | -13.2054 | -1.2790 | Photo | #5 |
| mcc5 | -13.3525 | -1.8360 | Photo | #5 |
| mcc7 | -11.8680 | -1.3241 | Photo | #5 |
| mcc8 | -12.6599 | -2.1267 | Photo | #5 |
| mlc1 | -11.5044 | -3.4916 | Photo | #5 |
| mlc2 | -10.7166 | -2.7316 | Photo | #5 |
| mlc3 | -10.0461 | -3.0362 | Photo | #5 |
| mlc4 | -10.8477 | -3.7819 | Photo | #5 |
| mlc5 | -10.9804 | -4.3174 | Photo | #5 |
| mlc7 | -9.5046 | -3.7873 | Photo | #5 |
| mlc8 | -10.3200 | -4.5259 | Photo | #5 |
| ***** | | | | |
| | #6 | -55.005 | 0.055 | 0.055 #6-806 |
| * | b | 16.4732 | 6.9266 | Photo #6 |
| | rtc1 | 5.1453 | -1.6760 | Photo #6 |
| | rtc2 | 7.3002 | -1.8480 | Photo #6 |
| | rtc3 | 7.2036 | -2.7801 | Photo #6 |
| | rtc4 | 5.0172 | -2.6084 | Photo #6 |
| | rtc7 | 7.0849 | -4.7990 | Photo #6 |
| | rtc8 | 5.0756 | -4.6199 | Photo #6 |
| * | cen1 | 10.4182 | -1.4826 | Photo #6 |
| | cen2 | 13.6490 | -1.7410 | Photo #6 |
| | cen3 | 13.7715 | -3.1759 | Photo #6 |
| | cen4 | 10.3611 | -2.9036 | Photo #6 |
| | cen8 | 10.1095 | -5.8326 | Photo #6 |
| * | lfc1 | 10.1170 | -6.0520 | Photo #6 |
| | lfc2 | 13.9637 | -6.4472 | Photo #6 |
| * | lfc3 | 14.0469 | -8.4311 | Photo #6 |
| | lfc4 | 9.9697 | -8.0371 | Photo #6 |
| * | lfc7 | 13.6024 | -11.7572 | Photo #6 |
| | lfc8 | 9.6807 | -11.3713 | Photo #6 |
| | ear1-l | -10.4178 | -7.4077 | Photo #6 |
| | ear2-l | -9.6974 | -6.2782 | Photo #6 |
| | ear3-l | -8.9027 | -5.1801 | Photo #6 |
| | ear4-l | -8.2312 | -4.1243 | Photo #6 |
| | mcc1 | -14.0906 | 0.1473 | Photo #6 |
| | mcc2 | -13.1084 | 0.5819 | Photo #6 |
| | mcc3 | -13.4055 | 0.0852 | Photo #6 |
| | mcc4 | -14.5359 | -0.3320 | Photo #6 |

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| | | | | |
|------|----------|---------|-------|----|
| mcc8 | -13.9401 | -1.4180 | Photo | #6 |
| mlc1 | -13.3825 | -3.2436 | Photo | #6 |
| mlc3 | -12.7118 | -3.3235 | Photo | #6 |
| mlc4 | -13.7781 | -3.7577 | Photo | #6 |
| mlc7 | -12.0847 | -4.4050 | Photo | #6 |
| mlc8 | -13.1860 | -4.8815 | Photo | #6 |

Initial Conditions Image Data File

| | | | | | | |
|--------|----------|----------|--------|--------|----|--|
| #1 | -55.003 | 0.025 | 0.025 | #1-580 | | |
| a | 4.0733 | -5.9268 | Photo | #1 | | |
| b | 3.9411 | -7.5439 | Photo | #1 | | |
| c | 9.0001 | -9.5576 | Photo | #1 | | |
| rtc1 | -3.6518 | -6.6810 | Photo | #1 | | |
| rtc2 | -5.2639 | -7.0111 | Photo | #1 | | |
| rtc3 | -5.7427 | -6.0392 | Photo | #1 | | |
| rtc4 | -4.0975 | -5.8006 | Photo | #1 | | |
| rtc5 | -3.6487 | -8.0633 | Photo | #1 | | |
| rtc6 | -5.2854 | -8.3587 | Photo | #1 | | |
| * | cen1 | -7.9262 | 4.3394 | Photo | #1 | |
| * | cen2 | -9.1381 | 4.2633 | Photo | #1 | |
| * | cen3 | -9.4991 | 4.7138 | Photo | #1 | |
| * | cen5 | -7.8691 | 3.1781 | Photo | #1 | |
| * | cen6 | -9.1218 | 3.0239 | Photo | #1 | |
| * | cen7 | -8.9064 | 5.6385 | Photo | #1 | |
| * | lfc1 | -10.4299 | 5.9394 | Photo | #1 | |
| * | lfc2 | -9.2076 | 6.0824 | Photo | #1 | |
| * | lfc4 | -10.0573 | 4.3687 | Photo | #1 | |
| * | lfc6 | -10.0467 | 4.3687 | Photo | #1 | |
| | lfc7 | -10.3618 | 4.7877 | Photo | #1 | |
| | m_r1 | 2.9145 | 2.1257 | Photo | #1 | |
| | m_r4 | 2.6727 | 2.4417 | Photo | #1 | |
| | m_t1 | 3.4948 | 4.3627 | Photo | #1 | |
| | m_t4 | 3.2826 | 4.5451 | Photo | #1 | |
| | m_b1 | 3.8175 | 3.0954 | Photo | #1 | |
| | m_b4 | 3.5655 | 3.3903 | Photo | #1 | |
| | mtar01 | 2.5248 | 1.9018 | Photo | #1 | |
| | mtar03 | 3.1365 | 4.1496 | Photo | #1 | |
| | mtar06 | 2.5579 | 2.3742 | Photo | #1 | |
| | mtar07 | 3.1597 | 4.5657 | Photo | #1 | |
| | mtar11 | 3.4749 | 3.3476 | Photo | #1 | |
| ***** | | | | | | |
| #2 | -55.003 | 0.025 | 0.025 | #2-736 | | |
| a | -2.0814 | -5.0775 | Photo | #2 | | |
| b | -1.9430 | -6.7281 | Photo | #2 | | |
| c | 6.1033 | -11.7813 | Photo | #2 | | |
| rtc1 | -10.1376 | -2.8134 | Photo | #2 | | |
| rtc2 | -11.4042 | -2.6223 | Photo | #2 | | |
| rtc3 | -10.6560 | -1.7977 | Photo | #2 | | |
| rtc4 | -9.3077 | -2.1061 | Photo | #2 | | |
| rtc5 | -9.9028 | -4.1039 | Photo | #2 | | |
| rtc6 | -11.2055 | -3.8221 | Photo | #2 | | |
| rtc8 | -9.1322 | -3.3717 | Photo | #2 | | |
| m_r1 | 3.4502 | 2.3454 | Photo | #2 | | |
| m_r4 | 3.6971 | 2.6581 | Photo | #2 | | |
| m_t1 | 5.5357 | 4.3027 | Photo | #2 | | |
| m_t4 | 5.7714 | 4.5703 | Photo | #2 | | |
| m_b1 | 5.9624 | 2.9070 | Photo | #2 | | |
| m_b4 | 6.1916 | 3.1990 | Photo | #2 | | |
| mtar01 | 3.0404 | 2.2183 | Photo | #2 | | |
| mtar03 | 5.1160 | 4.2004 | Photo | #2 | | |
| mtar06 | 3.3248 | 2.6526 | Photo | #2 | | |
| mtar07 | 5.3872 | 4.6529 | Photo | #2 | | |
| mtar09 | 5.5177 | 4.1245 | Photo | #2 | | |

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| | | | | |
|--------|----------|---------|-------|--------|
| mtar11 | 5.7814 | 3.1909 | Photo | #2 |
| ***** | | | | |
| #3 | -55.005 | 0.025 | 0.025 | #3-674 |
| a | -11.1395 | -3.1387 | Photo | #3 |
| b | -10.9820 | -4.7801 | Photo | #3 |
| d | 6.4082 | -0.5924 | Photo | #3 |
| e | 6.2630 | -1.9408 | Photo | #3 |
| f | -6.8496 | 11.5518 | Photo | #3 |
| rtc1 | -14.4433 | 1.1240 | Photo | #3 |
| rtc2 | -14.8350 | 1.6272 | Photo | #3 |
| rtc3 | -13.5483 | 1.9610 | Photo | #3 |
| rtc4 | -13.1546 | 1.3412 | Photo | #3 |
| rtc5 | -14.2932 | -0.0966 | Photo | #3 |
| rtc6 | -14.6648 | 0.3177 | Photo | #3 |
| rtc8 | -13.0006 | 0.1735 | Photo | #3 |
| cen1 | 2.4712 | 5.4102 | Photo | #3 |
| cen2 | 1.8198 | 5.8215 | Photo | #3 |
| cen3 | 2.8532 | 6.0024 | Photo | #3 |
| cen4 | 3.5179 | 5.5591 | Photo | #3 |
| cen5 | 2.3619 | 4.2667 | Photo | #3 |
| cen6 | 1.7245 | 4.6636 | Photo | #3 |
| cen8 | 3.4020 | 4.4511 | Photo | #3 |
| lfc1 | 5.5028 | 5.9217 | Photo | #3 |
| lfc2 | 4.8271 | 6.3123 | Photo | #3 |
| lfc3 | 5.7899 | 6.5081 | Photo | #3 |
| lfc4 | 6.4828 | 6.1138 | Photo | #3 |
| lfc5 | 5.4117 | 4.8453 | Photo | #3 |
| lfc6 | 4.7320 | 5.1934 | Photo | #3 |
| lfc8 | 6.3835 | 4.9739 | Photo | #3 |
| m_r1 | -2.3092 | 1.3017 | Photo | #3 |
| m_r4 | -1.6742 | 1.4210 | Photo | #3 |
| m_t1 | 0.2279 | 2.5063 | Photo | #3 |
| m_t4 | 0.8300 | 2.5517 | Photo | #3 |
| m_b1 | 0.3891 | 0.8726 | Photo | #3 |
| m_b4 | 1.0244 | 1.0201 | Photo | #3 |
| m_l1 | 1.2089 | 2.0383 | Photo | #3 |
| m_l4 | 1.8647 | 2.1501 | Photo | #3 |
| mtar01 | -2.5338 | 1.3328 | Photo | #3 |
| mtar03 | -0.0295 | 2.4672 | Photo | #3 |
| mtar06 | -2.1599 | 1.6390 | Photo | #3 |
| mtar07 | 0.4083 | 2.8008 | Photo | #3 |
| mtar08 | 1.4039 | 2.3643 | Photo | #3 |
| mtar09 | 0.4882 | 2.2840 | Photo | #3 |
| mtar11 | 0.5680 | 1.2977 | Photo | #3 |
| ***** | | | | |
| #4 | -55.004 | 0.025 | 0.025 | #4-623 |
| a | -10.8802 | 0.1685 | Photo | #4 |
| b | -10.7169 | -1.3150 | Photo | #4 |
| c | -12.2148 | -9.4314 | Photo | #4 |
| d | 7.0628 | -4.9962 | Photo | #4 |
| e | 6.9465 | -6.4794 | Photo | #4 |
| f | 15.8636 | 9.4537 | Photo | #4 |
| rtc1 | -8.2459 | 4.0027 | Photo | #4 |
| rtc2 | -7.6466 | 4.4882 | Photo | #4 |
| rtc3 | -6.6605 | 4.3339 | Photo | #4 |
| rtc4 | -7.2072 | 3.8594 | Photo | #4 |
| rtc5 | -8.1876 | 2.9329 | Photo | #4 |
| cen1 | 7.4741 | 2.5460 | Photo | #4 |
| cen2 | 7.7964 | 3.1067 | Photo | #4 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|--------------|----------|---------|-------|--------|
| cen3 | 9.1135 | 2.8838 | Photo | #4 |
| cen4 | 8.8578 | 2.3307 | Photo | #4 |
| cen5 | 7.3223 | 1.3686 | Photo | #4 |
| cen7 | 8.9790 | 1.6500 | Photo | #4 |
| cen8 | 8.6777 | 1.0756 | Photo | #4 |
| lfc1 | 11.5555 | 1.8434 | Photo | #4 |
| lfc2 | 11.8081 | 2.4318 | Photo | #4 |
| lfc3 | 13.2140 | 2.2240 | Photo | #4 |
| lfc4 | 12.9576 | 1.6321 | Photo | #4 |
| lfc5 | 11.4202 | 0.6242 | Photo | #4 |
| lfc7 | 13.0290 | 0.8806 | Photo | #4 |
| lfc8 | 12.8043 | 0.3916 | Photo | #4 |
| m_r1 | -5.0743 | 1.4645 | Photo | #4 |
| m_r4 | -4.4616 | 1.3635 | Photo | #4 |
| m_t1 | -3.9433 | 1.9328 | Photo | #4 |
| m_t4 | -3.2705 | 1.8217 | Photo | #4 |
| m_b1 | -4.1263 | 0.3528 | Photo | #4 |
| m_b4 | -3.4711 | 0.1992 | Photo | #4 |
| m_l1 | -1.5165 | 0.8221 | Photo | #4 |
| m_l4 | -0.8750 | 0.6753 | Photo | #4 |
| mtar06 | -4.6532 | 1.7187 | Photo | #4 |
| mtar07 | -3.4727 | 2.1945 | Photo | #4 |
| mtar08 | -1.0737 | 1.0482 | Photo | #4 |
| mtar09 | -3.5618 | 1.6216 | Photo | #4 |
| mtar11 | -3.6944 | 0.5716 | Photo | #4 |
| ***** | | | | |
| #5 | -55.002 | 0.025 | 0.025 | #5-591 |
| c | -8.8750 | -5.0654 | Photo | #5 |
| d | 4.0198 | -7.8227 | Photo | #5 |
| e | 3.9235 | -9.3762 | Photo | #5 |
| g | -5.4097 | 6.2945 | Photo | #5 |
| h | -16.6844 | 7.7931 | Photo | #5 |
| i | -17.2372 | -6.0178 | Photo | #5 |
| cen1 | 9.4364 | -0.7460 | Photo | #5 |
| cen2 | 10.7194 | -0.4372 | Photo | #5 |
| cen3 | 11.6261 | -1.1107 | Photo | #5 |
| cen4 | 10.3335 | -1.4512 | Photo | #5 |
| cen5 | 9.2890 | -2.0696 | Photo | #5 |
| cen7 | 11.4679 | -2.4721 | Photo | #5 |
| cen8 | 10.1681 | -2.7531 | Photo | #5 |
| lfc1 | 12.2063 | -2.8692 | Photo | #5 |
| lfc2 | 13.5391 | -2.4966 | Photo | #5 |
| lfc3 | 14.5771 | -3.2857 | Photo | #5 |
| lfc4 | 13.2244 | -3.6481 | Photo | #5 |
| lfc5 | 12.0106 | -4.2997 | Photo | #5 |
| lfc7 | 14.3491 | -4.7190 | Photo | #5 |
| lfc8 | 13.0245 | -5.0461 | Photo | #5 |
| m_t1 | -3.9025 | 2.9597 | Photo | #5 |
| m_t4 | -3.6723 | 2.6868 | Photo | #5 |
| m_b1 | -4.3260 | 1.5544 | Photo | #5 |
| m_b4 | -4.0812 | 1.2501 | Photo | #5 |
| m_l1 | -1.8748 | 1.1264 | Photo | #5 |
| m_l4 | -1.6664 | 0.8678 | Photo | #5 |
| mtar07 | -3.5228 | 3.0140 | Photo | #5 |
| mtar08 | -1.4640 | 1.1882 | Photo | #5 |
| mtar11 | -3.9256 | 1.6231 | Photo | #5 |
| ***** | | | | |

Site Survey Image Data File

| | | | | | |
|-------|---------|----------|-------|--------|--|
| #1 | -55.003 | 0.020 | 0.020 | #1-580 | |
| lfc1 | -5.7949 | 5.1351 | Photo | #1 | |
| lfc3 | -7.2231 | 5.4386 | Photo | #1 | |
| lfc4 | -6.0735 | 5.5303 | Photo | #1 | |
| lfc6 | -6.9536 | 3.9166 | Photo | #1 | |
| c1 | -4.8557 | 3.8962 | Photo | #1 | |
| c2 | -6.0864 | 3.7907 | Photo | #1 | |
| c3 | -6.3834 | 4.2044 | Photo | #1 | |
| c4 | -5.1808 | 4.3112 | Photo | #1 | |
| c5 | -4.8583 | 2.7129 | Photo | #1 | |
| xc6 | -5.0768 | 2.6152 | Photo | #1 | |
| c7 | -6.3904 | 3.0784 | Photo | #1 | |
| a | 6.7072 | -6.5844 | Photo | #1 | |
| b | 6.5145 | -8.2130 | Photo | #1 | |
| xc | 11.6547 | -10.4506 | Photo | #1 | |
| rtc1 | -0.9865 | -7.0918 | Photo | #1 | |
| rtc2 | -2.5984 | -7.3229 | Photo | #1 | |
| rtc3 | -3.0437 | -6.3967 | Photo | #1 | |
| rtc6 | -2.6446 | -8.7351 | Photo | #1 | |
| rtc7 | -3.0631 | -7.6721 | Photo | #1 | |
| sp1 | -0.8812 | -5.6827 | Photo | #1 | |
| sp2 | -2.5547 | -5.8857 | Photo | #1 | |
| sp3 | -2.9929 | -4.9675 | Photo | #1 | |
| sp4 | -1.3947 | -4.7651 | Photo | #1 | |
| x+12 | 7.2373 | -4.8752 | Photo | #1 | |
| x+18 | 11.5754 | -4.3390 | Photo | #1 | |
| xx+24 | 15.6944 | -3.8774 | Photo | #1 | |
| y+12 | -4.4051 | -1.0836 | Photo | #1 | |
| y+06 | -3.2994 | -3.3892 | Photo | #1 | |
| y-06 | -0.4486 | -9.1017 | Photo | #1 | |
| z+06 | -1.7586 | -1.6685 | Photo | #1 | |
| z+12 | -1.4802 | 3.1523 | Photo | #1 | |
| ***** | | | | | |
| #2 | -55.003 | 0.020 | 0.020 | #2-736 | |
| lfc1 | 3.2714 | 6.5929 | Photo | #2 | |
| lfc2 | 2.2186 | 6.7366 | Photo | #2 | |
| lfc3 | 2.6764 | 7.0876 | Photo | #2 | |
| lfc4 | 3.7063 | 6.9384 | Photo | #2 | |
| lfc5 | 3.2801 | 5.5026 | Photo | #2 | |
| c1 | 1.9758 | 5.4892 | Photo | #2 | |
| c2 | 0.8648 | 5.6429 | Photo | #2 | |
| c3 | 1.3386 | 6.0013 | Photo | #2 | |
| c4 | 2.4146 | 5.8469 | Photo | #2 | |
| c5 | 1.9674 | 4.3411 | Photo | #2 | |
| c6 | 0.8650 | 4.5092 | Photo | #2 | |
| c8 | 2.4153 | 4.7473 | Photo | #2 | |
| a | -0.0328 | -5.9851 | Photo | #2 | |
| b | 0.0327 | -7.6305 | Photo | #2 | |
| d | 7.4512 | 1.1925 | Photo | #2 | |
| e | 7.3906 | -0.0977 | Photo | #2 | |
| rtc1 | -7.9120 | -3.4810 | Photo | #2 | |
| rtc2 | -9.1450 | -3.2010 | Photo | #2 | |
| rtc4 | -7.0908 | -2.7661 | Photo | #2 | |
| rtc6 | -8.9672 | -4.4653 | Photo | #2 | |
| rtc8 | -6.9507 | -4.0293 | Photo | #2 | |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|-------|----------|---------|-------|--------|
| sp1 | -8.0549 | -2.1649 | Photo | #2 |
| sp2 | -9.3388 | -1.8709 | Photo | #2 |
| sp3 | -8.4818 | -1.1543 | Photo | #2 |
| sp4 | -7.2417 | -1.4510 | Photo | #2 |
| x+06 | -4.291 | -3.267 | Photo | #2 |
| x+12 | -0.1129 | -4.3138 | Photo | #2 |
| x+18 | 4.4902 | -5.5098 | Photo | #2 |
| x+24 | 9.3853 | -6.7941 | Photo | #2 |
| y+12 | -3.7281 | 1.6400 | Photo | #2 |
| y+06 | -5.8430 | -0.2239 | Photo | #2 |
| y-06 | -10.8802 | -4.6525 | Photo | #2 |
| z+06 | -8.7003 | 1.7261 | Photo | #2 |
| z+12 | -9.2215 | 6.1414 | Photo | #2 |
| <hr/> | | | | |
| #3 | -55.005 | 0.020 | 0.020 | #3-674 |
| lfc1 | 4.0397 | 5.5041 | Photo | #3 |
| lfc2 | 3.3822 | 5.9104 | Photo | #3 |
| lfc3 | 4.3475 | 6.0686 | Photo | #3 |
| lfc4 | 5.0157 | 5.6775 | Photo | #3 |
| lfc5 | 3.9276 | 4.3961 | Photo | #3 |
| lfc6 | 3.2902 | 4.8045 | Photo | #3 |
| lfc8 | 4.9122 | 4.5765 | Photo | #3 |
| c1 | 1.0056 | 5.0284 | Photo | #3 |
| c3 | 1.3374 | 5.5909 | Photo | #3 |
| c4 | 2.0284 | 5.1684 | Photo | #3 |
| c5 | 0.9178 | 3.8817 | Photo | #3 |
| c8 | 1.9329 | 4.0447 | Photo | #3 |
| a | -12.6827 | -3.4459 | Photo | #3 |
| b | -12.5170 | -5.0742 | Photo | #3 |
| d | 4.9602 | -1.0055 | Photo | #3 |
| e | 4.8275 | -2.3334 | Photo | #3 |
| rtc1 | -16.0460 | 0.8673 | Photo | #3 |
| rtc2 | -16.4107 | 1.3511 | Photo | #3 |
| rtc4 | -14.7222 | 1.1431 | Photo | #3 |
| sp1 | -16.2537 | 2.1037 | Photo | #3 |
| sp2 | -16.6145 | 2.6419 | Photo | #3 |
| sp3 | -15.2553 | 2.9138 | Photo | #3 |
| sp4 | -14.8698 | 2.3758 | Photo | #3 |
| x+06 | -14.5019 | 0.1988 | Photo | #3 |
| x+12 | -13.1821 | -1.7553 | Photo | #3 |
| x+18 | -11.6577 | -4.0109 | Photo | #3 |
| x+24 | -9.8755 | -6.6632 | Photo | #3 |
| y+12 | -7.9444 | 3.5109 | Photo | #3 |
| y+06 | -11.7075 | 2.7318 | Photo | #3 |
| z+06 | -16.1786 | 5.6897 | Photo | #3 |
| xz+12 | -16.7422 | 9.7612 | Photo | #3 |
| <hr/> | | | | |
| #4 | -55.004 | 0.020 | 0.020 | #4-623 |
| lfc1 | 11.9856 | 1.2442 | Photo | #4 |
| lfc2 | 12.2511 | 1.7817 | Photo | #4 |
| lfc3 | 13.6146 | 1.5487 | Photo | #4 |
| lfc4 | 13.3883 | 1.0000 | Photo | #4 |
| lfc5 | 11.8238 | -0.0178 | Photo | #4 |
| c1 | 7.8991 | 1.9887 | Photo | #4 |
| c2 | 8.2240 | 2.4982 | Photo | #4 |
| c3 | 9.5354 | 2.2570 | Photo | #4 |
| c4 | 9.2529 | 1.7262 | Photo | #4 |
| c5 | 7.7547 | 0.7611 | Photo | #4 |
| c7 | 9.3949 | 1.0326 | Photo | #4 |

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| | | | | |
|-------|----------|---------|-------|--------|
| c8 | 9.0995 | 0.4975 | Photo | #4 |
| a | -10.4645 | -0.1838 | Photo | #4 |
| b | -10.3155 | -1.6816 | Photo | #4 |
| c | -11.9078 | -9.7659 | Photo | #4 |
| d | 7.4771 | -5.5855 | Photo | #4 |
| e | 7.3383 | -7.0749 | Photo | #4 |
| rtc1 | -7.8348 | 3.6102 | Photo | #4 |
| rtc3 | -6.2303 | 3.8926 | Photo | #4 |
| rtc4 | -6.7993 | 3.4752 | Photo | #4 |
| sp1 | -7.9426 | 4.7458 | Photo | #4 |
| sp2 | -7.3425 | 5.1556 | Photo | #4 |
| sp3 | -6.3067 | 5.0077 | Photo | #4 |
| sp4 | -6.8889 | 4.6032 | Photo | #4 |
| x+06 | -8.8910 | 3.0027 | Photo | #4 |
| x+12 | -10.9770 | 1.4999 | Photo | #4 |
| x+18 | -13.3023 | -0.2410 | Photo | #4 |
| x+24 | -15.9514 | -2.2621 | Photo | #4 |
| y+12 | -0.4666 | 3.4284 | Photo | #4 |
| y+06 | -3.8499 | 3.8573 | Photo | #4 |
| y-06 | -10.1517 | 4.7047 | Photo | #4 |
| y-12 | -13.1429 | 5.0840 | Photo | #4 |
| z+06 | -7.3604 | 7.7035 | Photo | #4 |
| z+12 | -7.6641 | 11.3800 | Photo | #4 |
| ***** | | | | |
| #5 | -55.002 | 0.020 | 0.020 | #5-591 |
| lfc1 | 13.3795 | -1.6085 | Photo | #5 |
| lfc2 | 14.7298 | -1.2864 | Photo | #5 |
| lfc3 | 15.7318 | -2.0111 | Photo | #5 |
| lfc4 | 14.4085 | -2.3869 | Photo | #5 |
| lfc5 | 13.2096 | -3.0164 | Photo | #5 |
| lfc8 | 14.2222 | -3.7791 | Photo | #5 |
| c1 | 10.5775 | 0.4921 | Photo | #5 |
| c2 | 11.8470 | 0.8065 | Photo | #5 |
| c3 | 12.7689 | 0.1301 | Photo | #5 |
| c4 | 11.5012 | -0.1853 | Photo | #5 |
| c5 | 10.4317 | -0.8291 | Photo | #5 |
| c7 | 12.6007 | -1.2216 | Photo | #5 |
| c8 | 11.3409 | -1.5308 | Photo | #5 |
| a | -2.7736 | 3.4709 | Photo | #5 |
| b | -2.7222 | 2.0911 | Photo | #5 |
| c | -7.6505 | -3.8720 | Photo | #5 |
| d | 5.1662 | -6.6614 | Photo | #5 |
| e | 5.0906 | -8.1907 | Photo | #5 |
| g | -4.2882 | 7.4172 | Photo | #5 |
| h | -15.3891 | 8.7627 | Photo | #5 |
| i | -15.7543 | -4.8527 | Photo | #5 |
| rtc1 | 2.6955 | 5.8670 | Photo | #5 |
| rtc3 | 4.2374 | 5.7007 | Photo | #5 |
| rtc4 | 3.1984 | 5.5125 | Photo | #5 |
| sp1 | 2.6777 | 6.9694 | Photo | #5 |
| sp2 | 3.7358 | 7.1549 | Photo | #5 |
| sp3 | 4.2493 | 6.8127 | Photo | #5 |
| sp4 | 3.1962 | 6.6312 | Photo | #5 |
| x+06 | 0.2781 | 5.7630 | Photo | #5 |
| x+12 | -3.1115 | 5.1552 | Photo | #5 |
| x+18 | -6.6368 | 4.4791 | Photo | #5 |
| yx+24 | -10.3156 | 3.7349 | Photo | #5 |
| y+12 | 6.9283 | 4.0150 | Photo | #5 |
| y+06 | 5.0857 | 5.2340 | Photo | #5 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|-------|---------|----------|-------|--------|
| Xy-06 | 3.9596 | 7.3648 | Photo | #5 |
| y-12 | 0.5790 | 8.2080 | Photo | #5 |
| z+06 | 3.4629 | 9.7016 | Photo | #5 |
| ***** | | | | |
| #6 | -55.005 | 0.020 | 0.020 | #6-806 |
| lfc1 | 2.4619 | -7.3557 | Photo | #6 |
| lfc2 | 4.1722 | -7.6623 | Photo | #6 |
| lfc3 | 3.6394 | -8.6773 | Photo | #6 |
| Xlfc4 | 3.8602 | -8.3064 | Photo | #6 |
| lfc6 | 4.1490 | -9.1757 | Photo | #6 |
| lfc7 | 3.6160 | -10.1749 | Photo | #6 |
| lfc8 | 1.8773 | -9.8583 | Photo | #6 |
| c1 | 3.9168 | -4.7417 | Photo | #6 |
| c2 | 5.5280 | -5.0057 | Photo | #6 |
| c3 | 5.0931 | -5.8876 | Photo | #6 |
| c4 | 3.4403 | -5.6032 | Photo | #6 |
| c7 | 5.0483 | -7.3159 | Photo | #6 |
| c8 | 3.4226 | -7.0360 | Photo | #6 |
| c | -2.5993 | -4.1716 | Photo | #6 |
| d | -3.5502 | -9.3521 | Photo | #6 |
| e | -3.4781 | -10.9654 | Photo | #6 |
| g | 12.5777 | 3.6942 | Photo | #6 |
| h | 3.0283 | 7.6486 | Photo | #6 |
| i | -1.7179 | -3.7904 | Photo | #6 |
| rtc2 | 11.2539 | 1.1715 | Photo | #6 |
| rtc3 | 11.0150 | 0.7755 | Photo | #6 |
| rtc4 | 9.7846 | 0.9472 | Photo | #6 |
| sp1 | 10.1463 | 2.5314 | Photo | #6 |
| sp2 | 11.3748 | 2.3577 | Photo | #6 |
| sp3 | 11.1379 | 1.9639 | Photo | #6 |
| sp4 | 9.8826 | 2.1281 | Photo | #6 |
| x+06 | 6.9469 | 2.1357 | Photo | #6 |
| x+12 | 3.4434 | 2.5823 | Photo | #6 |
| x+18 | 0.0651 | 2.9968 | Photo | #6 |
| x+24 | -3.1824 | 3.3527 | Photo | #6 |
| y+12 | 8.8903 | -1.1057 | Photo | #6 |
| y+06 | 9.7853 | 0.3410 | Photo | #6 |
| y-06 | 11.2744 | 2.8317 | Photo | #6 |
| y-12 | 11.9040 | 3.9156 | Photo | #6 |
| z+06 | 10.8673 | 5.2170 | Photo | #6 |
| z+12 | 11.1705 | 9.0396 | Photo | #6 |
| ***** | | | | |

Appendix B

GIANT Files

Input Files

GIANT has two input files: Image Data File (IMG.DAT) and Program Options & Input File (OPT.DAT). Examples of Image Data Files were given in Appendix A.

Initial Conditions OPT.DAT File

(Note: Only five cameras were used for this run. Six cameras are normally used.)

```

02111010001009000 11          0.0      0.0
      .0005      .0005      .0005  object space control
#1-580      -57.092
#2-736      -56.988
#3-674      -57.295
#4-623      -57.434
#5-591      -57.292
*****
#1      -0.420      -1.298      0.938      0.1      0.1      0.1
#1  195026.815 -280651.283  41841.376  20000.  20000.  20000.
#2      0.959      -1.266      0.962      0.1      0.1      0.1
#2  3325245.322 -292850.340 -15808.992  20000.  20000.  20000.
#3      1.861      -0.392      0.912      0.1      0.1      0.1
#3  2993522.783 -282517.808  5422.861  20000.  20000.  20000.
#4      1.886      1.124      0.863      0.1      0.1      0.1
#4  2465401.190 -261854.437 -14203.303  20000.  20000.  20000.
#5      1.003      2.043      0.816      0.1      0.1      0.1
#5  2020334.515 -261000.348 -22254.677  20000.  20000.  20000.
*****
a      0.2977      0.0099      -0.0707
b      0.2988      0.0088      -0.1351
c      0.5555      0.0766      -0.3266
d      0.2991      0.7227      -0.1620
e      0.2996      0.7200      -0.2236
g      0.0549      -0.9181      -0.2093
h      0.6597      -1.0184      -0.0603
i      0.8362      -0.6713      -0.7043
rtc1     0.0252      -0.0249      -0.0250
rtc2     -0.0247      -0.0250      -0.0261
rtc3     -0.0252      0.0251      -0.0255
rtc4     0.0253      0.0250      -0.0253
rtc6     -0.0246      -0.0254      -0.0767
rtc7     -0.0246      0.0256      -0.0756
rtc8     0.0254      0.0252      -0.0765
cen1     0.0701      0.6693      0.0204
cen2     0.0197      0.6681      0.0200
cen3     0.0181      0.7182      0.0163
cen4     0.0682      0.7196      0.0166
cen5     0.0706      0.6656      -0.0303

```

Anthropometry and Initial Conditions Photogrammetric Program

| | | | |
|------|--------|--------|---------|
| cen7 | 0.0190 | 0.7157 | -0.0337 |
| cen8 | 0.0688 | 0.7164 | -0.0336 |
| lfc1 | 0.0653 | 0.8193 | 0.0114 |
| lfc2 | 0.0152 | 0.8187 | 0.0111 |
| lfc3 | 0.0145 | 0.8687 | 0.0085 |
| lfc4 | 0.0646 | 0.8699 | 0.0088 |
| lfc5 | 0.0662 | 0.8170 | -0.0394 |
| lfc6 | 0.0156 | 0.8152 | -0.0391 |
| lfc8 | 0.0648 | 0.8673 | -0.0411 |

Body Anthropometry OPT.DAT File

```
02111000001009000 10
    .00025    .00025    .00025
LfEyLfSh    -838.200
RtEyLfSh    -838.200
LfEyRtSh    -838.200
RtEyRtSh    -838.200
*****
LfEyLfSh    0.506    -0.451    -0.080    0.01    0.01    0.01
LfEyLfSh 3151911.056    -1059.271    1647.281    10000.    10000.    10000.
RtEyLfSh    0.548    -0.413    -0.078    0.01    0.01    0.01
RtEyLfSh 3150729.283    -1631.101    10108.979    10000.    10000.    10000.
LfEyRtSh    0.515    0.470    -0.068    0.01    0.01    0.01
LfEyRtSh 2223804.999    -13008.431    -13520.960    10000.    10000.    10000.
RtEyRtSh    0.483    0.499    -0.067    0.01    0.01    0.01
RtEyRtSh 2221908.014    -13824.763    -12002.768    10000.    10000.    10000.
*****
r1        0.0325    -0.0468    0.00356
r2        0.0309    -0.0460    -0.02190
r3        0.0309    -0.0241    -0.02180
r4        0.0315    -0.0242    0.00280
r5        0.0523    -0.0460    0.00305
r6        0.0521    -0.0467    -0.02200
r7        0.0526    -0.0232    -0.02160
r8        0.0532    -0.0243    0.00330
c1        -0.03073   -0.00731   0.00178
c2        -0.03073   -0.00698   -0.01870
c3        -0.03073   0.01422   -0.02286
c4        -0.03100   0.01574   0.00254
c5        -0.00813   -0.00757   0.00254
c6        -0.00838   -0.00879   -0.01994
c7        -0.00787   0.01550   -0.02060
c8        -0.00762   0.01641   0.00216
11        0.03048   0.03300   0.00317
12        0.03073   0.03380   -0.02020
13        0.03109   0.05500   -0.02060
14        0.03020   0.05640   0.00330
15        0.05385   0.03400   0.00315
16        0.05260   0.03400   -0.02010
17        0.05160   0.05550   -0.02060
18        0.05385   0.05610   0.00315
*****
```

Body Anthropometry OPT.DAT File — Premount Modification

```
HRV # 0227
00001010001109000 2
0.000250 0.000250 0.000250
LfEyLfSh -889.000 0.250 0.250
RtEyLfSh -889.000 0.250 0.250
LfEyRtSh -889.000 0.250 0.250
RtEyRtSh -889.000 0.250 0.250
*****
LfEyLfSh -0.446 0.003 0.724 0.04 0.04 0.04
LfEyLfSh -30753.786 324055.341 53224.185 20000. 20000. 50000.
RtEyLfSh -0.412 -0.004 0.750 0.04 0.04 0.04
RtEyLfSh -25648.055 365055.966 42450.451 20000. 20000. 50000.
LfEyRtSh 0.310 0.013 0.825 0.04 0.04 0.04
LfEyRtSh 1216.754 -285642.826 -21733.348 20000. 20000. 50000.
RtEyRtSh 0.413 0.022 0.780 0.04 0.04 0.04
RtEyRtSh 902.372 -294739.770 -21416.237 20000. 20000. 50000.
*****
ctp .0000 .0000 .0000 0
rtp -.0889 .0000 .0635 0
ltp .0889 .0000 .0635 0
*****
```

Head Anthropometry OPT.DAT File

```

02111000001009000 11
.00025   .00025   .00025 object space control -- instrument coordinates
#1-580   -57.092
#2-736   -56.988
#3-674   -57.295
#4-623   -57.434
#5-591   -57.292
#6-806   -57.539
*****
#1      -0.215    -1.296    -0.704     .010     .010     .010
#1  123907.524  212026.467 1140044.621  10000.  10000.  10000.
#2      -0.681    -1.365     0.234     .010     .010     .010
#2  281640.865 -145943.634 1233733.229  10000. 100000. 10000.
#3      -0.881    -0.523     0.734     .010     .010     .010
#3  643038.319 -451500.948 1565717.778  10000.  10000.  10000.
#4      -0.870     0.156     0.750     .010     .010     .010
#4  950102.260 -463437.760-1773742.194  10000.  10000.  10000.
#5      -0.669     0.994     0.337     .010     .010     .010
#5  1375856.349 -263803.624-1350102.512  10000.  10000.  10000.
#6      -0.217     0.995    -0.568     .010     .010     .010
#6  1633732.172 160415.301-1105627.125  10000.  10000.  10000.
*****
mrc1     .02950    -.04813     .00457
mrc2     .02950    -.04813    -.02032
mrc3     .02950    -.02375    -.02032
mrc4     .02950    -.02375     .00457
mrc5     .05490    -.04813     .00457
mrc6     .05490    -.04813    -.02032
mrc7     .05490    -.02375    -.02032
mrc8     .05490    -.02375     .00457
mcc1    -.03200    -.00838     .00457
mcc2    -.03200    -.00838    -.02172
mcc3    -.03200     .01753    -.02172
mcc4    -.03200     .01753     .00457
mcc5   -.00635    -.00838     .00457
mcc6   -.00635    -.00838    -.02172
mcc7   -.00635     .01753    -.02172
mcc8   -.00635     .01753     .00457
mlc1     .02980     .03152     .00508
mlc2     .02980     .03152    -.02045
mlc3     .02980     .05705    -.02045
mlc4     .02980     .05705     .00508
mlc5     .05480     .03152     .00508
mlc6     .05476     .03152    -.02045
mlc7     .05480     .05705    -.02045
mlc8     .05480     .05705     .00508
*****

```

Head Anthropometry OPT.DAT File — Premount Modification

HRV # 0222
00001010001109000 1
0.000250 0.000250 0.000250
AP CAM -1820.09
LAT CAM - 889.00

A/Phrv45 1.068 0.577 1.160 0.10 0.10 0.10
A/Phrv45 211014.306 -491537.856 84935.941 10000. 10000. 10000.
A/Pprism 0.523 0.234 1.618 0.10 0.10 0.10
A/Pprism 15412.372 -224814.291 -4329.419 10000. 10000. 10000.
LAThrv45 -0.500 0.259 0.672 0.10 0.10 0.10
LAThrv45 190143.916 392138.153 -165243.147 10000. 10000. 10000.
LATprism -0.645 0.172 0.415 0.10 0.10 0.10
LATprism 32255.040 682534.993 -20135.417 10000. 10000. 10000.

c1 -0.0469 0.0508 0.0194 0.0005 0.0005 0.0005 0
c2 -0.2347 0.0508 0.0972 0.0005 0.0005 0.0005 0
c3 -0.2347 0.2540 0.0972 0.0005 0.0005 0.0005 0
c4 -0.0469 0.2540 0.0194 0.0005 0.0005 0.0005 0
c5 0.0237 0.2540 0.0573 0.0005 0.0005 0.0005 0
c6 0.0194 0.0508 0.0469 0.0005 0.0005 0.0005 0
c7 0.0972 0.0508 0.2347 0.0005 0.0005 0.0005 0
c8 0.0972 0.2540 0.2347 0.0005 0.0005 0.0005 0
c9 0.0503 0.1524 0.2541 0 0
c10 -0.0825 0.1524 0.1991 0 0
c11 -0.2152 0.1524 0.1441 0 0
c12 -0.0825 0.0508 0.1991 0 0
c13 -0.0825 0.2540 0.1991 0 0

Site Survey OPT.DAT File

```

02111010001009000 11      0.0      0.0
  0.0005  0.0005  0.0005      object space control
  #1-580   -57.092
  #2-736   -56.988
  #3-674   -57.295
  #4-623   -57.434
  #5-591   -57.292
  #6-806   -57.539
*****
  #1      -0.420   -1.298    0.938    0.1      0.1      0.1
  #1  195026.815 -280651.283  41841.376  20000.  20000.  20000.
  #2      0.959   -1.266    0.962    0.1      0.1      0.1
  #2  3325245.322 -292850.340 -15808.992  20000.  20000.  20000.
  #3      1.861   -0.392    0.912    0.1      0.1      0.1
  #3  2993522.783 -282517.808  5422.861  20000.  20000.  20000.
  #4      1.886    1.124    0.863    0.1      0.1      0.1
  #4  2465401.190 -261854.437 -14203.303  20000.  20000.  20000.
  #5      1.003    2.043    0.816    0.1      0.1      0.1
  #5  2020334.515 -261000.348 -22254.677  20000.  20000.  20000.
  #6     -0.361    2.092    0.787    0.1      0.1      0.1
  #6  1583448.831 -222547.057 -1108.903  20000.  20000.  20000.
*****
  sp1      0.0254   -0.0254    0.0254
  sp2     -0.0254   -0.0254    0.0254
  sp3     -0.0254    0.0254    0.0254
  sp4      0.0254    0.0254    0.0254
  rtc1      0.0254   -0.0254   -0.0254
  rtc2     -0.0254   -0.0254   -0.0254
  rtc3     -0.0254    0.0254   -0.0254
  rtc4      0.0254    0.0254   -0.0254
  rtc5      0.0254   -0.0254   -0.0762
  rtc6     -0.0254   -0.0254   -0.0762
  rtc7     -0.0254    0.0254   -0.0762
  rtc8      0.0254    0.0254   -0.0762
  z+12     0.0000    0.0000    0.3048
  z+06     0.0000    0.0000    0.1524
  y+12     0.0000    0.3048    0.0000
  y+06     0.0000    0.1524    0.0000
  y-06     0.0000   -0.1524    0.0000
  y-12     0.0000   -0.3048    0.0000
  x+24     0.6048    0.0000    0.0000
  x+18     0.4572    0.0000    0.0000
  x+12     0.3048    0.0000    0.0000
  x+06     0.1524    0.0000    0.0000
*****
  #2      .600     -1.500     .600     0.2      0.2      0.2
  #2  710920.170  272650.444  90718.956  500.    500.    500.
  #3      1.500     0.000     .600     0.2      0.2      0.2
  #3  492355.502  664443.019  395816.778  500.    500.    500.
  #4      1.500     .600     .600     0.2      0.2      0.2
  #4 -101342.721  713806.049  1002814.067  500.    500.    500.
  #5      .600     2.700     .600     0.2      0.2      0.2
  #5 -612956.739  410812.461  1601544.882  500.    500.    500.
  #6     -.300     2.700     .600     0.2      0.2      0.2
  #6 -663405.275 -82306.154 -1755645.212  500.    500.    500.

```

Anthropometry and Initial Conditions Photogrammetric Program

Output Files

Initial Conditions Output File

NBDL GIANT: 08:47 05/19/92 Page 1
35mm Still Camera System For Initial Conditions Of RUN # = LX6422

Object Space Reference System is Rectangular
Rotation angles are Terrestrial Object-to-Photo
Complete Triangulation process is requested
Error Propagation is requested
[Variance/Covariance output]

Unit Variance will be based on completely free camera parameters
All Image Residuals will be listed
Triangulated Object Coordinates will not be saved
Adjusted Camera Station Parameters will be saved

NBDL GIANT: 08:47 05/19/92 Page 2
35mm Still Camera System For Initial Conditions Of RUN # = LX6422

E R R O R W A R N I N G S

POINTS NOT PHOTOGRAPHED

rtc7

PASS POINTS APPEARING ON 1 PHOTO

* cen1 * cen3 * cen5 * cen7
* lfcl * lfcl2 * lfcl4 * lfcl6

NBDL GIANT: 08:47 05/19/92 Page 3
35mm Still Camera System For Initial Conditions Of RUN # = LX6422

C A M E R A S T A T I O N S C O R R E C T I O N S

----- P O S I T I O N ----- ----- A T T I T U D E -----

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | X | Y | Z | Azim. | Elev. | Swing |
|----|---------|---------|------------|-------------|-----------|-----------|
| | | | | Iteration 1 | | |
| #1 | 0.0045 | 0.0320 | -0.0175 m. | -0.053781 | -0.016545 | -0.030237 |
| #2 | 0.0110 | 0.0194 | -0.0004 m. | -0.034333 | -0.014277 | -0.023851 |
| #3 | 0.0075 | 0.0197 | 0.0144 m. | 0.018638 | -0.051629 | 0.033912 |
| #4 | -0.0065 | 0.0106 | -0.0028 m. | -0.005101 | 0.012266 | -0.021293 |
| #5 | 0.0080 | -0.0048 | -0.0066 m. | 0.030224 | -0.018579 | 0.015213 |

Provisional Weighted Sum of Squares = 634521.

| | X | Y | Z | Azim. | Elev. | Swing |
|----|---------|---------|------------|-------------|-----------|-----------|
| | | | | Iteration 2 | | |
| #1 | -0.0006 | -0.0076 | 0.0035 m. | 0.001399 | -0.000585 | -0.001253 |
| #2 | -0.0114 | -0.0087 | 0.0020 m. | -0.007168 | 0.000838 | 0.000339 |
| #3 | 0.0010 | -0.0012 | -0.0006 m. | -0.000375 | -0.000185 | 0.000226 |
| #4 | 0.0013 | -0.0012 | -0.0006 m. | 0.000628 | 0.000346 | 0.000065 |
| #5 | 0.0004 | 0.0011 | 0.0014 m. | -0.000296 | -0.000139 | 0.000113 |

Provisional Weighted Sum of Squares = 1176.94

| | X | Y | Z | Azim. | Elev. | Swing |
|----|--------|--------|-----------|-------------|-----------|-----------|
| | | | | Iteration 3 | | |
| #1 | 0.0000 | 0.0000 | 0.0000 m. | 0.000001 | -0.000010 | -0.000014 |
| #2 | 0.0004 | 0.0003 | 0.0000 m. | 0.000244 | -0.000077 | 0.000011 |
| #3 | 0.0000 | 0.0000 | 0.0000 m. | -0.000008 | 0.000037 | -0.000031 |
| #4 | 0.0000 | 0.0000 | 0.0000 m. | 0.000019 | 0.000017 | -0.000012 |
| #5 | 0.0000 | 0.0000 | 0.0000 m. | -0.000003 | 0.000003 | -0.000004 |

Provisional Weighted Sum of Squares = 274.075

| | X | Y | Z | Azim. | Elev. | Swing |
|----|--------|--------|-----------|-------------|-----------|-----------|
| | | | | Iteration 4 | | |
| #1 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |
| #2 | 0.0000 | 0.0000 | 0.0000 m. | -0.000004 | 0.000006 | -0.000002 |
| #3 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | -0.000001 | 0.000001 |
| #4 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | -0.000001 | 0.000001 |
| #5 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |

Provisional Weighted Sum of Squares = 274.024

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92
 35mm Still Camera System For Initial Conditions Of Page 4
 RUN # = LX6422

| T R I A N G U L A T E D | | I M A G E | P O I N T S | R E S I D U A L S |
|-------------------------|-----|------------------|-------------|-------------------|
| | | (in micrometers) | | |
| a *0* | #1 | #2 | #3 | #4 |
| | 19 | 0 | -39 | 22 |
| | 40 | -30 | -50 | 27 |
| b *0* | #1 | #2 | #3 | #4 |
| | 2 | -6 | -19 | 16 |
| | 9 | -19 | -22 | 21 |
| c *0* | #2 | #1 | #4 | #5 |
| | 30 | -59 | -6 | -28 |
| | -34 | 4 | 8 | 62 |
| rtc1 *0* | #2 | #3 | #1 | #4 |
| | 8 | -22 | 14 | -2 |
| | -13 | -19 | -4 | 24 |
| rtc2 *0* | #1 | #2 | #3 | #4 |
| | -3 | -12 | 14 | -38 |
| | 4 | 46 | -9 | -57 |
| rtc3 *0* | #1 | #2 | #3 | #4 |
| | -19 | 41 | 17 | 1 |
| | 5 | 8 | -29 | -8 |
| rtc4 *0* | #2 | #1 | #3 | #4 |
| | -2 | -23 | 5 | -21 |
| | 16 | 15 | 24 | 4 |
| rtc5 | #2 | #3 | #1 | #4 |
| | -4 | -5 | 12 | 19 |
| | 1 | 0 | -2 | 2 |
| rtc6 *0* | #1 | #2 | #3 | |
| | 0 | 13 | 26 | |
| | -54 | -25 | 110 | |
| cen2 *0* | #3 | #1 | #4 | #5 |
| | 9 | -40 | 0 | -26 |
| | 0 | -6 | -17 | 6 |
| cen6 | #1 | #3 | | |
| | 0 | 1 | | |
| | -3 | 3 | | |
| lfc7 | #1 | #4 | #5 | |
| | 32 | -6 | 18 | |
| | -17 | 33 | -16 | |
| m_r1 | #2 | #3 | #4 | #1 |
| | 3 | -9 | 10 | 2 |
| | 0 | -12 | 5 | 6 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 08:47 05/19/92
 35mm Still Camera System For Initial Conditions Of Page 5
 RUN # = LX6422

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
 (in micrometers)

| | T R I A N G U L A T E D | I M A G E | P O I N T S | R E S I D U A L S |
|-----------------|--------------------------------|------------------|--------------------|--------------------------|
| | | | (in micrometers) | |
| m_r4 | #2 16 -7 | #1 0 -18 | #3 -3 16 | #4 6 8 |
| m_t1 | #1 25 -11 | #2 -3 11 | #3 1 -16 | #4 9 21 |
| m_t4 | #3 21 32 | #2 -12 -25 | #1 -7 16 | #4 -29 -13 |
| m_b1 | #3 7 25 | #1 19 10 | #2 -14 -11 | #4 -13 -3 |
| m_b4 | #3 28 15 | #2 -10 -19 | #1 10 -25 | #4 0 18 |
| mtar01 | #1 0 12 | #3 -3 -32 | #2 -11 20 | |
| mtar03 | #3 12 16 | #1 12 -12 | #2 -10 -6 | |
| mtar06 | #3 5 -10 | #2 -23 26 | #1 4 7 | #4 -11 -23 |
| mtar07 | #3 5 18 | #1 1 21 | #2 -5 -20 | #4 -12 -26 |
| mtar11 | #1 -3 1 | #2 -4 39 | #3 -6 -45 | #4 0 14 |
| rtc8 *0* | #2 0 25 | #3 18 4 | | |
| mtar09 | #3 -16 -11 | #4 6 -7 | #2 6 19 | |
| d *0* | #4 37 -11 | #5 -39 -38 | #3 -4 14 | |

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92
 35mm Still Camera System For Initial Conditions Of Page 6
 RUN # = LX6422

| T R I A N G U L A T E D | I M A G E | P O I N T S | R E S I D U A L S |
|-------------------------|------------------|------------------|-------------------|
| | (in micrometers) | | |
| e *0* | #4 29 -13 | #3 13 13 | #5 -22 -45 |
| f | #3 2 -20 | #4 2 18 | |
| cen1 *0* | #4 5 15 | #5 -6 9 | #3 -13 -8 |
| cen3 *0* | #3 -6 -18 | #4 3 -22 | #5 -12 3 |
| cen4 *0* | #3 -23 10 | #4 -22 -12 | #5 4 13 |
| cen5 *0* | #4 17 -29 | #5 -11 18 | #3 0 -5 |
| cen8 *0* | #3 -4 -6 | #5 0 -14 | #4 5 18 |
| lfc1 *0* | #3 -17 0 | #5 18 6 | #4 0 23 |
| lfc2 *0* | #4 -2 -7 | #3 6 13 | #5 13 -15 |
| lfc3 *0* | #4 -26 -24 | #5 10 18 | #3 20 -14 |
| lfc4 *0* | #5 16 15 | #4 9 3 | #3 -7 -13 |
| lfc5 *0* | #5 31 31 | #3 -7 -33 | #4 -11 -12 |
| lfc6 *0* | #3 1 30 | | |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 08:47 05/19/92
 35mm Still Camera System For Initial Conditions Of Page 7
 RUN # = LX6422

| T R I A N G U L A T E D | I M A G E | P O I N T S | R E S I D U A L S |
|-------------------------|------------------|-------------|-------------------|
| | (in micrometers) | | |

| | | | |
|----------|------------------|-----------------|-----------------|
| lfc8 *0* | #4 -8 -2 | #5 20 3 | #3 -11 33 |
| m_11 | #4 -4 9 | #5 1 -7 | #3 3 -3 |
| m_14 | #5 -5 -25 | #3 0 3 | #4 -4 22 |
| mtar08 | #4 7 2 | #5 -7 -3 | #3 -6 1 |
| cen7 *0* | #5 -28 18 | #4 14 -10 | |
| g *0* | #5 -59 -23 | | |
| h *0* | #5 47 -30 | | |
| i *0* | #5 18 47 | | |

| | |
|------------------------------------|-------|
| Weighted Sum of Squares (Camera) = | 10.6 |
| Weighted Sum of Squares (Object) = | 23.0 |
| Weighted Sum of Squares (Plates) = | 198.9 |

| | |
|-----------------------------------|-------|
| Weighted Sum of Squares (Total) = | 232.6 |
| Degrees of Freedom..... = | 219 |

| | |
|--|-------|
| a posteriori Variance of Unit Weight = | 1.062 |
|--|-------|

Anthropometry and Initial Conditions Photogrammetric Program

NBDSL GIANT: 08:47 05/19/92

35mm Still Camera System For Initial Conditions Of

Page 8
RUN # = LX6422

T R I A N G U L A T E D C A M E R A S T A T I O N S
(Terrestrial->Ph)

| Ident | Position/Attitude | Covariance Matrix |
|-------|--|--|
| #1 | X = -0.4161 m. Y = -1.2737 m. Z = 0.9240 m. Azim. = 23 23 7.7343 Elev. == 28 28 22.2050 Swing = 04 30 20.1043 | +6.464E-06 -1.127E-06 +1.874E-06 -1.127E-06 +3.629E-06 -1.916E-06 +1.874E-06 -1.916E-06 +1.211E-05 +2.215E-06 -8.075E-07 -9.951E-07 -8.075E-07 +2.215E-06 -9.951E-07 -9.951E-07 -9.951E-07 +1.899E-06 |
| #2 | X = 0.9589 m. Y = -1.2551 m. Z = 0.9635 m. Azim. = 335 20 18.8974 Elev. == 30 44 10.5319 Swing == 02 22 27.9251 | +8.445E-05 +1.558E-05 -2.980E-05 +1.558E-05 +3.261E-05 +3.255E-05 -2.980E-05 +3.255E-05 +7.439E-05 +2.659E-05 +5.336E-06 -5.121E-06 +5.336E-06 +2.659E-05 -5.121E-06 -5.121E-06 -5.121E-06 +7.303E-06 |
| #3 | X = 1.8695 m. Y = -0.3735 m. Z = 0.9258 m. Azim. = 297 15 51.8284 Elev. == 29 08 19.2178 Swing == 00 32 43.9160 | +5.670E-06 +4.617E-06 -1.719E-07 +4.617E-06 +8.153E-06 +2.155E-06 -1.719E-07 +2.155E-06 +7.046E-06 +1.768E-06 -6.505E-07 +5.537E-08 -6.505E-07 +1.768E-06 +5.537E-08 +5.537E-08 +5.537E-08 +4.103E-06 |
| #4 | X = 1.8808 m. Y = 1.1334 m. Z = 0.8596 m. Azim. = 247 02 10.9444 Elev. == 26 46 59.3300 Swing == 02 15 41.0295 | +4.551E-06 -3.575E-06 -1.163E-06 -3.575E-06 +8.362E-06 -2.180E-06 -1.163E-06 -2.180E-06 +7.209E-06 +1.828E-06 +3.716E-07 -6.554E-08 +3.716E-07 +1.828E-06 -6.554E-08 -6.554E-08 -6.554E-08 +5.368E-06 |
| #5 | X = 1.0114 m. Y = 2.0392 m. Z = 0.8108 m. Azim. = 203 43 47.2399 Elev. == 24 52 19.6241 Swing == 01 09 39.0473 | +6.005E-06 +1.816E-06 +1.160E-06 +1.816E-06 +1.593E-06 -2.155E-07 +1.160E-06 -2.155E-07 +5.105E-06 +8.511E-07 -1.164E-07 +4.012E-07 -1.164E-07 +8.511E-07 +4.012E-07 +4.012E-07 +4.012E-07 +1.824E-06 |

S U M M A R Y S T A T I S T I C S F O R C A M E R A S T A T I O N S

RMS For Standard Deviations

| | | |
|-----------|---------------|-----------------------|
| Count = 5 | X = 0.0046 m. | Azim. = 00 08 51.9034 |
| | Y = 0.0033 m. | Elev. = 00 10 24.0679 |
| | Z = 0.0046 m. | Swing = 00 06 57.6248 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 08:47 05/19/92 Page 9
 35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | | Covariance Matrix | | | Std Dev (m) |
|----------|-------------------|---------|--|-------------------|------------|------------|-------------|
| | X = | 0.2974 | | +1.740E-07 | +6.278E-09 | +1.107E-08 | 0.0004 |
| a *0* | Y = | 0.0104 | | +6.278E-09 | +1.653E-07 | -1.666E-08 | 0.0004 |
| | Z = | -0.0706 | | +1.107E-08 | -1.666E-08 | +1.631E-07 | 0.0004 |
| | X = | 0.2989 | | +1.677E-07 | +4.085E-09 | +1.403E-08 | 0.0004 |
| b *0* | Y = | 0.0091 | | +4.085E-09 | +1.622E-07 | -1.839E-08 | 0.0004 |
| | Z = | -0.1350 | | +1.403E-08 | -1.839E-08 | +1.634E-07 | 0.0004 |
| | X = | 0.5555 | | +1.869E-07 | +7.241E-09 | +1.116E-08 | 0.0004 |
| c *0* | Y = | 0.0768 | | +7.241E-09 | +1.947E-07 | +2.325E-09 | 0.0004 |
| | Z = | -0.3269 | | +1.116E-08 | +2.325E-09 | +1.948E-07 | 0.0004 |
| | X = | 0.2987 | | +1.884E-07 | +8.421E-09 | +3.027E-08 | 0.0004 |
| d *0* | Y = | 0.7222 | | +8.421E-09 | +1.711E-07 | +1.450E-08 | 0.0004 |
| | Z = | -0.1616 | | +3.027E-08 | +1.450E-08 | +1.751E-07 | 0.0004 |
| | X = | 0.2992 | | +1.894E-07 | +8.250E-09 | +3.095E-08 | 0.0004 |
| e *0* | Y = | 0.7193 | | +8.250E-09 | +1.702E-07 | +1.494E-08 | 0.0004 |
| | Z = | -0.2231 | | +3.095E-08 | +1.494E-08 | +1.784E-07 | 0.0004 |
| | X = | -1.3294 | | +4.304E-05 | -4.595E-06 | +1.208E-05 | 0.0066 |
| f | Y = | 0.7979 | | -4.595E-06 | +4.974E-06 | -1.245E-06 | 0.0022 |
| | Z = | -0.1228 | | +1.208E-05 | -1.245E-06 | +7.801E-06 | 0.0028 |
| | X = | 0.0545 | | +2.488E-07 | +4.645E-09 | +2.198E-09 | 0.0005 |
| g *0* | Y = | -0.9180 | | +4.645E-09 | +2.627E-07 | +3.735E-09 | 0.0005 |
| | Z = | -0.2092 | | +2.198E-09 | +3.735E-09 | +2.526E-07 | 0.0005 |
| | X = | 0.6600 | | +2.454E-07 | +2.079E-09 | +8.145E-10 | 0.0005 |
| h *0* | Y = | -1.0185 | | +2.079E-09 | +2.637E-07 | +5.551E-09 | 0.0005 |
| | Z = | -0.0600 | | +8.145E-10 | +5.551E-09 | +2.457E-07 | 0.0005 |
| | X = | 0.8364 | | +2.462E-07 | +1.675E-10 | +1.937E-09 | 0.0005 |
| i *0* | Y = | -0.6712 | | +1.675E-10 | +2.603E-07 | +9.387E-09 | 0.0005 |
| | Z = | -0.7046 | | +1.937E-09 | +9.387E-09 | +2.485E-07 | 0.0005 |
| | X = | 0.0702 | | +1.965E-07 | +1.487E-08 | +2.825E-08 | 0.0004 |
| cen1 *0* | Y = | 0.6695 | | +1.487E-08 | +1.697E-07 | +1.042E-08 | 0.0004 |
| | Z = | 0.0202 | | +2.825E-08 | +1.042E-08 | +1.635E-07 | 0.0004 |
| | X = | 0.0197 | | +1.825E-07 | +1.510E-08 | +2.446E-08 | 0.0004 |
| cen2 *0* | Y = | 0.6682 | | +1.510E-08 | +1.669E-07 | +4.339E-09 | 0.0004 |
| | Z = | 0.0202 | | +2.446E-08 | +4.339E-09 | +1.556E-07 | 0.0004 |
| | X = | 0.0179 | | +1.989E-07 | +1.525E-08 | +2.814E-08 | 0.0004 |
| cen3 *0* | Y = | 0.7183 | | +1.525E-08 | +1.694E-07 | +1.058E-08 | 0.0004 |
| | Z = | 0.0166 | | +2.814E-08 | +1.058E-08 | +1.653E-07 | 0.0004 |
| | X = | 0.0683 | | +1.959E-07 | +1.498E-08 | +2.846E-08 | 0.0004 |
| cen4 *0* | Y = | 0.7200 | | +1.498E-08 | +1.683E-07 | +1.073E-08 | 0.0004 |
| | Z = | 0.0165 | | +2.846E-08 | +1.073E-08 | +1.634E-07 | 0.0004 |

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92

35mm Still Camera System For Initial Conditions Of

Page 10
RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | | Covariance Matrix | | | Std Dev (m) |
|----------|-------------------|---------|--|-------------------|------------|------------|-------------|
| cen5 *0* | X = | 0.0704 | | +1.964E-07 | +1.444E-08 | +2.914E-08 | 0.0004 |
| | Y = | 0.6656 | | +1.444E-08 | +1.699E-07 | +1.124E-08 | 0.0004 |
| | Z = | -0.0302 | | +2.914E-08 | +1.124E-08 | +1.661E-07 | 0.0004 |
| cen6 | X = | 0.0204 | | +1.276E-06 | -4.484E-07 | +4.119E-07 | 0.0011 |
| | Y = | 0.6633 | | -4.484E-07 | +1.674E-06 | -6.546E-07 | 0.0013 |
| | Z = | -0.0311 | | +4.119E-07 | -6.546E-07 | +1.154E-06 | 0.0011 |
| cen7 *0* | X = | 0.0187 | | +2.118E-07 | +2.906E-08 | +2.738E-08 | 0.0005 |
| | Y = | 0.7158 | | +2.906E-08 | +1.926E-07 | +2.005E-08 | 0.0004 |
| | Z = | -0.0338 | | +2.738E-08 | +2.005E-08 | +1.859E-07 | 0.0004 |
| cen8 *0* | X = | 0.0689 | | +1.958E-07 | +1.451E-08 | +2.941E-08 | 0.0004 |
| | Y = | 0.7163 | | +1.451E-08 | +1.687E-07 | +1.151E-08 | 0.0004 |
| | Z = | -0.0336 | | +2.941E-08 | +1.151E-08 | +1.660E-07 | 0.0004 |
| lfc1 *0* | X = | 0.0657 | | +1.949E-07 | +1.510E-08 | +2.895E-08 | 0.0004 |
| | Y = | 0.8194 | | +1.510E-08 | +1.658E-07 | +1.135E-08 | 0.0004 |
| | Z = | 0.0111 | | +2.895E-08 | +1.135E-08 | +1.634E-07 | 0.0004 |
| lfc2 *0* | X = | 0.0153 | | +1.983E-07 | +1.518E-08 | +2.871E-08 | 0.0004 |
| | Y = | 0.8185 | | +1.518E-08 | +1.675E-07 | +1.128E-08 | 0.0004 |
| | Z = | 0.0112 | | +2.871E-08 | +1.128E-08 | +1.651E-07 | 0.0004 |
| lfc3 *0* | X = | 0.0144 | | +1.982E-07 | +1.501E-08 | +2.910E-08 | 0.0004 |
| | Y = | 0.8688 | | +1.501E-08 | +1.668E-07 | +1.162E-08 | 0.0004 |
| | Z = | 0.0087 | | +2.910E-08 | +1.162E-08 | +1.652E-07 | 0.0004 |
| lfc4 *0* | X = | 0.0649 | | +1.946E-07 | +1.507E-08 | +2.928E-08 | 0.0004 |
| | Y = | 0.8698 | | +1.507E-08 | +1.647E-07 | +1.164E-08 | 0.0004 |
| | Z = | 0.0087 | | +2.928E-08 | +1.164E-08 | +1.637E-07 | 0.0004 |
| lfc5 *0* | X = | 0.0665 | | +1.949E-07 | +1.454E-08 | +3.007E-08 | 0.0004 |
| | Y = | 0.8172 | | +1.454E-08 | +1.665E-07 | +1.198E-08 | 0.0004 |
| | Z = | -0.0394 | | +3.007E-08 | +1.198E-08 | +1.662E-07 | 0.0004 |
| lfc6 *0* | X = | 0.0157 | | +2.481E-07 | -1.635E-08 | +1.336E-08 | 0.0005 |
| | Y = | 0.8151 | | -1.635E-08 | +2.329E-07 | -8.751E-09 | 0.0005 |
| | Z = | -0.0394 | | +1.336E-08 | -8.751E-09 | +2.291E-07 | 0.0005 |
| lfc7 | X = | 0.0151 | | +1.081E-06 | +5.146E-07 | +4.363E-07 | 0.0010 |
| | Y = | 0.8667 | | +5.146E-07 | +7.990E-07 | +2.980E-07 | 0.0009 |
| | Z = | -0.0435 | | +4.363E-07 | +2.980E-07 | +6.476E-07 | 0.0008 |
| lfc8 *0* | X = | 0.0652 | | +1.947E-07 | +1.448E-08 | +3.047E-08 | 0.0004 |
| | Y = | 0.8673 | | +1.448E-08 | +1.656E-07 | +1.212E-08 | 0.0004 |
| | Z = | -0.0414 | | +3.047E-08 | +1.212E-08 | +1.665E-07 | 0.0004 |
| m_b1 | X = | 0.4426 | | +4.856E-07 | +8.406E-08 | +9.592E-08 | 0.0007 |
| | Y = | 0.3770 | | +8.406E-08 | +6.617E-07 | +8.215E-09 | 0.0008 |
| | Z = | 0.0610 | | +9.592E-08 | +8.215E-09 | +3.880E-07 | 0.0006 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBBL GIANT: 08:47 05/19/92

35mm Still Camera System For Initial Conditions Of

Page 11
RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | | Covariance Matrix | Std Dev (m) |
|----------|-------------------|---------|------------|-------------------|-------------|
| m_b4 | X = | 0.4432 | +4.992E-07 | +8.936E-08 | +1.046E-07 |
| | Y = | 0.4015 | +8.936E-08 | +6.729E-07 | +1.740E-08 |
| | Z = | 0.0603 | +1.046E-07 | +1.740E-08 | +3.979E-07 |
| m_11 | X = | 0.3785 | +8.510E-07 | +1.769E-07 | +2.904E-07 |
| | Y = | 0.4429 | +1.769E-07 | +7.128E-07 | +1.356E-07 |
| | Z = | 0.0587 | +2.904E-07 | +1.356E-07 | +5.603E-07 |
| m_14 | X = | 0.3812 | +8.431E-07 | +1.713E-07 | +2.877E-07 |
| | Y = | 0.4672 | +1.713E-07 | +7.102E-07 | +1.338E-07 |
| | Z = | 0.0586 | +2.877E-07 | +1.338E-07 | +5.608E-07 |
| m_r1 | X = | 0.3750 | +5.278E-07 | +2.259E-08 | +1.052E-07 |
| | Y = | 0.3092 | +2.259E-08 | +6.204E-07 | -7.672E-08 |
| | Z = | 0.0614 | +1.052E-07 | -7.672E-08 | +4.199E-07 |
| m_r4 | X = | 0.3758 | +5.416E-07 | +2.388E-08 | +1.134E-07 |
| | Y = | 0.3328 | +2.388E-08 | +6.331E-07 | -7.194E-08 |
| | Z = | 0.0615 | +1.134E-07 | -7.194E-08 | +4.289E-07 |
| m_t1 | X = | 0.4255 | +4.964E-07 | +8.312E-08 | +8.654E-08 |
| | Y = | 0.3801 | +8.312E-08 | +6.831E-07 | +5.775E-09 |
| | Z = | 0.1119 | +8.654E-08 | +5.775E-09 | +3.749E-07 |
| m_t4 | X = | 0.4261 | +5.068E-07 | +8.763E-08 | +9.454E-08 |
| | Y = | 0.4031 | +8.763E-08 | +6.929E-07 | +1.373E-08 |
| | Z = | 0.1102 | +9.454E-08 | +1.373E-08 | +3.838E-07 |
| rtc1 *0* | X = | 0.0249 | +1.628E-07 | -2.363E-09 | +1.401E-08 |
| | Y = | -0.0244 | -2.363E-09 | +1.626E-07 | -2.030E-08 |
| | Z = | -0.0249 | +1.401E-08 | -2.030E-08 | +1.584E-07 |
| rtc2 *0* | X = | -0.0249 | +1.652E-07 | -3.041E-09 | +1.378E-08 |
| | Y = | -0.0251 | -3.041E-09 | +1.657E-07 | -2.079E-08 |
| | Z = | -0.0261 | +1.378E-08 | -2.079E-08 | +1.616E-07 |
| rtc3 *0* | X = | -0.0255 | +1.653E-07 | -2.973E-09 | +1.354E-08 |
| | Y = | 0.0245 | -2.973E-09 | +1.660E-07 | -2.070E-08 |
| | Z = | -0.0252 | +1.354E-08 | -2.070E-08 | +1.604E-07 |
| rtc4 *0* | X = | 0.0256 | +1.617E-07 | -2.712E-09 | +1.443E-08 |
| | Y = | 0.0248 | -2.712E-09 | +1.627E-07 | -2.035E-08 |
| | Z = | -0.0259 | +1.443E-08 | -2.035E-08 | +1.564E-07 |
| rtc5 | X = | 0.0266 | +4.157E-07 | -3.722E-08 | +9.723E-08 |
| | Y = | -0.0255 | -3.722E-08 | +4.379E-07 | -1.485E-07 |
| | Z = | -0.0747 | +9.723E-08 | -1.485E-07 | +4.311E-07 |
| rtc6 *0* | X = | -0.0243 | +1.716E-07 | -9.050E-09 | +1.208E-08 |
| | Y = | -0.0254 | -9.050E-09 | +1.803E-07 | -2.972E-08 |
| | Z = | -0.0768 | +1.208E-08 | -2.972E-08 | +1.762E-07 |

Anthropometry and Initial Conditions Photogrammetric Program

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 35mm Still Camera System For Initial Conditions Of RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | Covariance Matrix | Std Dev (m) |
|----------|-------------------|----------------------------------|-------------|
| rtc8 *0* | X = 0.0254 | +2.146E-07 -2.335E-08 +2.792E-08 | 0.0005 |
| | Y = 0.0248 | -2.335E-08 +1.945E-07 -2.030E-08 | 0.0004 |
| | Z = -0.0768 | +2.792E-08 -2.030E-08 +1.982E-07 | 0.0004 |
| mtar01 | X = 0.3598 | +5.951E-07 -1.162E-07 +1.476E-07 | 0.0008 |
| | Y = 0.3080 | -1.162E-07 +9.873E-07 -3.053E-07 | 0.0010 |
| | Z = 0.0551 | +1.476E-07 -3.053E-07 +6.109E-07 | 0.0008 |
| mtar03 | X = 0.4105 | +6.704E-07 -1.140E-07 +1.567E-07 | 0.0008 |
| | Y = 0.3786 | -1.140E-07 +1.149E-06 -2.941E-07 | 0.0011 |
| | Z = 0.1055 | +1.567E-07 -2.941E-07 +6.479E-07 | 0.0008 |
| mtar06 | X = 0.3653 | +5.319E-07 +2.035E-08 +1.078E-07 | 0.0007 |
| | Y = 0.3201 | +2.035E-08 +6.211E-07 -7.385E-08 | 0.0008 |
| | Z = 0.0672 | +1.078E-07 -7.385E-08 +4.183E-07 | 0.0006 |
| mtar07 | X = 0.4159 | +4.996E-07 +8.401E-08 +9.004E-08 | 0.0007 |
| | Y = 0.3921 | +8.401E-08 +6.815E-07 +9.648E-09 | 0.0008 |
| | Z = 0.1170 | +9.004E-08 +9.648E-09 +2.740E-07 | 0.0006 |
| mtar08 | X = 0.3688 | +8.512E-07 +1.766E-07 +2.885E-07 | 0.0009 |
| | Y = 0.4555 | +1.766E-07 +7.038E-07 +1.331E-07 | 0.0008 |
| | Z = 0.0642 | +2.885E-07 +1.331E-07 +5.532E-07 | 0.0007 |
| mtar09 | X = 0.4217 | +8.977E-07 -6.048E-08 +2.875E-07 | 0.0009 |
| | Y = 0.3911 | -6.048E-08 +7.958E-07 -7.179E-08 | 0.0009 |
| | Z = 0.0995 | +2.875E-07 -7.179E-08 +6.158E-07 | 0.0008 |
| mtar11 | X = 0.4324 | +4.891E-07 +8.507E-08 +9.887E-08 | 0.0007 |
| | Y = 0.3887 | +8.507E-08 +6.600E-07 +1.215E-08 | 0.0008 |
| | Z = 0.0667 | +9.887E-08 +1.215E-08 +3.863E-07 | 0.0006 |

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

| | | |
|------------|------------|--------|
| Count = 19 | X = 0.0017 | meters |
| Count = 19 | Y = 0.0010 | meters |
| Count = 19 | Z = 0.0010 | meters |

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 35mm Still Camera System For Initial Conditions Of RUN # = LX6422

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

| | | | |
|------|---------------|------|---------------|
| lfc1 | X = 0.0004 m | rtc1 | X = -0.0003 m |
| | Y = 0.0001 m | | Y = 0.0005 m |
| | Z = -0.0003 m | | Z = 0.0001 m |
| cen1 | X = 0.0001 m | lfc2 | X = 0.0001 m |
| | Y = 0.0002 m | | Y = -0.0002 m |
| | Z = -0.0002 m | | Z = 0.0001 m |

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| | | | |
|------|---------------|------|---------------|
| rtc2 | X = -0.0002 m | cen2 | X = 0.0000 m |
| | Y = -0.0001 m | | Y = 0.0001 m |
| | Z = 0.0000 m | | Z = 0.0002 m |
| lfc3 | X = -0.0001 m | rtc3 | X = -0.0003 m |
| | Y = 0.0001 m | | Y = -0.0006 m |
| | Z = 0.0002 m | | Z = 0.0003 m |
| cen3 | X = -0.0002 m | lfc4 | X = 0.0003 m |
| | Y = 0.0001 m | | Y = -0.0001 m |
| | Z = 0.0003 m | | Z = -0.0001 m |
| rtc4 | X = 0.0003 m | cen4 | X = 0.0001 m |
| | Y = -0.0002 m | | Y = 0.0004 m |
| | Z = -0.0006 m | | Z = -0.0001 m |
| lfc5 | X = 0.0003 m | cen5 | X = -0.0002 m |
| | Y = 0.0002 m | | Y = 0.0000 m |
| | Z = 0.0000 m | | Z = 0.0001 m |
| lfc6 | X = 0.0001 m | rtc6 | X = 0.0003 m |
| | Y = -0.0001 m | | Y = 0.0000 m |
| | Z = -0.0003 m | | Z = -0.0001 m |
| cen7 | X = -0.0003 m | lfc8 | X = 0.0004 m |
| | Y = 0.0001 m | | Y = 0.0000 m |
| | Z = -0.0001 m | | Z = -0.0003 m |
| rtc8 | X = 0.0000 m | cen8 | X = 0.0001 m |
| | Y = -0.0004 m | | Y = -0.0001 m |
| | Z = -0.0003 m | | Z = 0.0000 m |
| a | X = -0.0003 m | b | X = 0.0001 m |
| | Y = 0.0005 m | | Y = 0.0003 m |
| | Z = 0.0001 m | | Z = 0.0001 m |
| c | X = 0.0000 m | d | X = -0.0004 m |
| | Y = 0.0002 m | | Y = -0.0005 m |
| | Z = -0.0003 m | | Z = 0.0004 m |
| e | X = -0.0004 m | g | X = -0.0004 m |
| | Y = -0.0007 m | | Y = 0.0001 m |
| | Z = 0.0005 m | | Z = 0.0001 m |

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 35mm Still Camera System For Initial Conditions Of RUN # = LX6422

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

| | | | |
|---|---------------|---|---------------|
| h | X = 0.0003 m | i | X = 0.0002 m |
| | Y = -0.0001 m | | Y = 0.0001 m |
| | Z = 0.0003 m | | Z = -0.0003 m |

| | |
|----------------------------------|---------------------|
| X Number of Components = 28 | RMS = 0.0003 meters |
| Y Number of Components = 28 | RMS = 0.0003 meters |
| Z Number of Components = 28 | RMS = 0.0003 meters |

Initial Conditions Variables Output File

```
MOUT
mrc1
-0.8648E-01 0.4629E+00 0.1269E+01
 0.9093E-06 -0.6112E-07 0.2316E-06
-0.6112E-07 0.7139E-06 -0.1220E-06
 0.2316E-06 -0.1220E-06 0.5972E-06
mrc2
-0.1076E+00 0.4632E+00 0.1279E+01
 0.9149E-06 -0.6451E-07 0.2245E-06
-0.6451E-07 0.7217E-06 -0.1228E-06
 0.2245E-06 -0.1228E-06 0.5902E-06
mrc3
-0.1077E+00 0.4877E+00 0.1278E+01
 0.1180E-05 -0.1490E-06 0.8757E-07
-0.1490E-06 0.6389E-05 -0.2296E-05
 0.8757E-07 -0.2296E-05 0.1990E-05
mrc4
-0.8646E-01 0.4860E+00 0.1267E+01
 0.1124E-05 -0.4158E-06 0.3245E-06
-0.4158E-06 0.1481E-05 -0.4862E-06
 0.3245E-06 -0.4862E-06 0.9088E-06
mrc5
-0.9708E-01 0.4618E+00 0.1247E+01
 0.9150E-06 -0.6718E-07 0.2429E-06
-0.6718E-07 0.7240E-06 -0.1321E-06
 0.2429E-06 -0.1321E-06 0.6160E-06
mrc6
-0.1192E+00 0.4632E+00 0.1257E+01
 0.1112E-05 -0.3978E-06 0.3177E-06
-0.3978E-06 0.1463E-05 -0.4859E-06
 0.3177E-06 -0.4859E-06 0.9078E-06
mrc8
-0.9644E-01 0.4851E+00 0.1247E+01
 0.1772E-05 -0.3121E-06 0.6742E-06
-0.3121E-06 0.8256E-06 -0.1980E-06
 0.6742E-06 -0.1980E-06 0.9296E-06
mcc1
-0.5581E-01 0.5008E+00 0.1320E+01
 0.4963E-06 -0.8871E-08 0.7922E-07
-0.8871E-08 0.5400E-06 0.1556E-07
 0.7922E-07 0.1556E-07 0.3653E-06
mcc2
-0.7629E-01 0.5012E+00 0.1331E+01
 0.4924E-06 -0.7829E-08 0.7519E-07
-0.7829E-08 0.5429E-06 0.1690E-07
 0.7519E-07 0.1690E-07 0.3583E-06
mcc3
-0.7654E-01 0.5244E+00 0.1330E+01
 0.4914E-06 -0.1173E-07 0.7500E-07
-0.1173E-07 0.5382E-06 0.2014E-07
 0.7500E-07 0.2014E-07 0.3569E-06
mcc4
-0.5577E-01 0.5243E+00 0.1319E+01
 0.4955E-06 -0.1291E-07 0.7911E-07
-0.1291E-07 0.5353E-06 0.1879E-07
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

0.7911E-07 0.1879E-07 0.3640E-06
mcc5
-0.6706E-01 0.5015E+00 0.1298E+01
0.6681E-06 0.5306E-07 0.1510E-06
0.5306E-07 0.6056E-06 -0.7331E-08
0.1510E-06 -0.7331E-08 0.4541E-06
mcc6
-0.8913E-01 0.5006E+00 0.1309E+01
0.1128E-05 -0.4259E-06 0.2983E-06
-0.4259E-06 0.1499E-05 -0.4519E-06
0.2983E-06 -0.4519E-06 0.8629E-06
mcc7
-0.8884E-01 0.5244E+00 0.1310E+01
0.3775E-05 0.2246E-05 0.1791E-05
0.2246E-05 0.2502E-05 0.1348E-05
0.1791E-05 0.1348E-05 0.1757E-05
mcc8
-0.6609E-01 0.5244E+00 0.1298E+01
0.5921E-06 -0.4204E-07 0.1162E-06
-0.4204E-07 0.5729E-06 0.4435E-07
0.1162E-06 0.4435E-07 0.4262E-06
mlc1
-0.8271E-01 0.5402E+00 0.1266E+01
0.8253E-06 0.1786E-06 0.2136E-06
0.1786E-06 0.1012E-05 0.3492E-06
0.2136E-06 0.3492E-06 0.7516E-06
mlc2
-0.1051E+00 0.5392E+00 0.1277E+01
0.3976E-05 0.2308E-05 0.1999E-05
0.2308E-05 0.2505E-05 0.1455E-05
0.1999E-05 0.1455E-05 0.1948E-05
mlc3
-0.1036E+00 0.5633E+00 0.1278E+01
0.1519E-05 0.2323E-06 0.5673E-06
0.2323E-06 0.7246E-06 0.1619E-06
0.5673E-06 0.1619E-06 0.8159E-06
mlc4
-0.8294E-01 0.5628E+00 0.1266E+01
0.7063E-06 0.1768E-08 0.1617E-06
0.1768E-08 0.6098E-06 0.1124E-06
0.1617E-06 0.1124E-06 0.5203E-06
mlc5
-0.9514E-01 0.5393E+00 0.1245E+01
0.1533E-05 0.2380E-06 0.6140E-06
0.2380E-06 0.7394E-06 0.1739E-06
0.6140E-06 0.1739E-06 0.8753E-06
mlc7
-0.1154E+00 0.5644E+00 0.1256E+01
0.8123E-06 0.1706E-06 0.2090E-06
0.1706E-06 0.9951E-06 0.3556E-06
0.2090E-06 0.3556E-06 0.7489E-06
mlc8
-0.9365E-01 0.5631E+00 0.1245E+01
0.7120E-06 0.6653E-08 0.1706E-06
0.6653E-08 0.6166E-06 0.1209E-06
0.1706E-06 0.1209E-06 0.5373E-06
EOEOF
NECK
nrc1

Anthropometry and Initial Conditions Photogrammetric Program

-0.4169E+00 0.4776E+00 0.1298E+01
0.4786E-06 -0.2392E-07 0.5230E-07
-0.2392E-07 0.8547E-06 0.3863E-07
0.5230E-07 0.3863E-07 0.4152E-06
nrc2
-0.4169E+00 0.4769E+00 0.1274E+01
0.1217E-05 -0.5895E-06 0.3408E-06
-0.5895E-06 0.1903E-05 -0.6128E-06
0.3408E-06 -0.6128E-06 0.9826E-06
nrc4
-0.4156E+00 0.5013E+00 0.1297E+01
0.8176E-06 -0.4946E-07 0.1461E-06
-0.4946E-07 0.1036E-05 -0.1327E-06
0.1461E-06 -0.1327E-06 0.6077E-06
nrc5
-0.3915E+00 0.4771E+00 0.1297E+01
0.4772E-06 -0.2757E-07 0.5198E-07
-0.2757E-07 0.8471E-06 0.3636E-07
0.5198E-07 0.3636E-07 0.4142E-06
nrc6
-0.3926E+00 0.4756E+00 0.1273E+01
0.8046E-06 -0.5173E-07 0.1487E-06
-0.5173E-07 0.1023E-05 -0.1439E-06
0.1487E-06 -0.1439E-06 0.6149E-06
nrc7
-0.3917E+00 0.4999E+00 0.1271E+01
0.1577E-05 -0.1488E-06 0.4309E-06
-0.1488E-06 0.1111E-05 -0.5962E-07
0.4309E-06 -0.5962E-07 0.8985E-06
nrc8
-0.3909E+00 0.5006E+00 0.1296E+01
0.4722E-06 -0.2556E-07 0.5084E-07
-0.2556E-07 0.8426E-06 0.4789E-07
0.5084E-07 0.4789E-07 0.4130E-06
ncc1
-0.4759E+00 0.5038E+00 0.1298E+01
0.4683E-06 -0.9856E-08 0.5362E-07
-0.9856E-08 0.8679E-06 0.5707E-07
0.5362E-07 0.5707E-07 0.4195E-06
ncc2
-0.4755E+00 0.5010E+00 0.1274E+01
0.1398E-05 -0.1409E-05 0.5925E-06
-0.1409E-05 0.7676E-05 -0.2836E-05
0.5925E-06 -0.2836E-05 0.2213E-05
ncc3
-0.4757E+00 0.5315E+00 0.1274E+01
0.6341E-06 0.6131E-07 -0.1935E-08
0.6131E-07 0.3477E-05 0.6309E-06
-0.1935E-08 0.6309E-06 0.9106E-06
ncc4
-0.4754E+00 0.5278E+00 0.1296E+01
0.5392E-06 -0.1542E-06 0.3631E-07
-0.1542E-06 0.1196E-05 0.4205E-07
0.3631E-07 0.4205E-07 0.4985E-06
ncc5
-0.4520E+00 0.5033E+00 0.1299E+01
0.4839E-06 0.5372E-07 0.4304E-07
0.5372E-07 0.1350E-05 0.1379E-06
0.4304E-07 0.1379E-06 0.5007E-06

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

ncc6
-0.4518E+00 0.4986E+00 0.1275E+01
0.1357E-05 -0.1291E-05 0.5438E-06
-0.1291E-05 0.7511E-05 -0.2769E-05
0.5438E-06 -0.2769E-05 0.2177E-05
ncc8
-0.4515E+00 0.5268E+00 0.1297E+01
0.5791E-06 0.2720E-06 0.8541E-07
0.2720E-06 0.1927E-05 0.3870E-06
0.8541E-07 0.3870E-06 0.6536E-06
nlc1
-0.4154E+00 0.5561E+00 0.1294E+01
0.8009E-06 0.3342E-06 0.2306E-06
0.3342E-06 0.1309E-05 0.4913E-06
0.2306E-06 0.4913E-06 0.7726E-06
nlc3
-0.4166E+00 0.5774E+00 0.1268E+01
0.7915E-06 0.3223E-06 0.2375E-06
0.3223E-06 0.1274E-05 0.5088E-06
0.2375E-06 0.5088E-06 0.8008E-06
nlc4
-0.4155E+00 0.5776E+00 0.1292E+01
0.6030E-06 0.1010E-06 0.1146E-06
0.1010E-06 0.9140E-06 0.2391E-06
0.1146E-06 0.2391E-06 0.5483E-06
nlc5
-0.3912E+00 0.5542E+00 0.1293E+01
0.4724E-06 0.6826E-07 0.6348E-07
0.6826E-07 0.8051E-06 0.1057E-06
0.6348E-07 0.1057E-06 0.4162E-06
nlc6
-0.3909E+00 0.5528E+00 0.1270E+01
0.1766E-05 0.3526E-06 0.5265E-06
0.3526E-06 0.1101E-05 0.1662E-06
0.5265E-06 0.1662E-06 0.9276E-06
nlc7
-0.3922E+00 0.5773E+00 0.1267E+01
0.6131E-06 0.9385E-07 0.1188E-06
0.9385E-07 0.9022E-06 0.2410E-06
0.1188E-06 0.2410E-06 0.5648E-06
nlc8
-0.3915E+00 0.5776E+00 0.1291E+01
0.4680E-06 0.6728E-07 0.6385E-07
0.6728E-07 0.7895E-06 0.1145E-06
0.6385E-07 0.1145E-06 0.4159E-06
EOFEOF
EOFEOF

Anthropometry and Initial Conditions Photogrammetric Program

Head Anthropometry Output File

NBDL GIANT: 09:17 10/13/92
35mm Still Camera System for Head Anthropometry of Page 1
HRV # = 0253

Object Space Reference System is Rectangular

Rotation angles are Terrestrial Object-to-Photo

Complete Triangulation process is requested

Error Propagation is requested

[Variance/Covariance output]

Unit Variance will be based on completely free camera parameters

All Image Residuals will be listed

Triangulated Object Coordinates will be saved

Adjusted Camera Station Parameters will be saved

NBDL GIANT: 09:17 10/13/92 Page 2
35mm Still Camera System for Head Anthropometry of HRV # = 0253

E R R O R W A R N I N G S

POINTS NOT PHOTOGRAPHED

mrc7 mlc6

PASS POINTS APPEARING ON 1 PHOTO

| | | | | | | | |
|---|------|---|------|---|------|---|------|
| | j | | k | * | a | * | j |
| * | rtc5 | | lfc7 | * | b | | rtc7 |
| * | cen1 | * | lfc1 | * | lfc3 | * | lfc7 |

NBDL GIANT: 09:17 10/13/92 Page 3
35mm Still Camera System for Head Anthropometry of HRV # = 0253

C A M E R A S T A T I O N S C O R R E C T I O N S

----- P O S I T I O N ----- ----- A T T I T U D E -----

| X | Y | Z | Azim. | Elev. | Swing |
|---|---|---|-------|-------|-------|
|---|---|---|-------|-------|-------|

Iteration 1

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | | | | | | |
|----|---------|--------|------------|-----------|-----------|-----------|
| #1 | -0.0037 | 0.0023 | -0.0120 m. | -0.004066 | 0.008765 | 0.015261 |
| #2 | -0.0128 | 0.0011 | -0.0112 m. | -0.009281 | 0.007311 | 0.009436 |
| #3 | -0.0116 | 0.0032 | -0.0095 m. | -0.011792 | 0.001311 | -0.000853 |
| #4 | -0.0070 | 0.0022 | -0.0092 m. | -0.009982 | -0.003119 | -0.007529 |
| #5 | -0.0002 | 0.0021 | -0.0046 m. | -0.002934 | -0.005424 | -0.013494 |
| #6 | 0.0098 | 0.0038 | -0.0001 m. | 0.006825 | 0.000337 | -0.009053 |

Provisional Weighted Sum of Squares = 210.083

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 35mm Still Camera System for Head Anthropometry of Page 4
 HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
 (in micrometers)

| a | #1 | #3 | #4 | |
|--------|-----|-----|-----|-----|
| | -2 | 5 | -5 | |
| | 2 | 0 | -1 | |
| rtc1 | #2 | #1 | #3 | #4 |
| | -3 | 6 | -24 | 9 |
| | -24 | 23 | 10 | -10 |
| | | | | -32 |
| rtc2 | #2 | #3 | #1 | #4 |
| | -2 | -47 | -42 | 10 |
| | 8 | 8 | 28 | -57 |
| | | | | -24 |
| rtc3 | #1 | #2 | #3 | #4 |
| | -1 | -18 | 19 | 24 |
| | -17 | -5 | 3 | -11 |
| | | | | 34 |
| rtc4 | #2 | #1 | #3 | #4 |
| | 13 | -9 | 21 | -12 |
| | 9 | -22 | 4 | 1 |
| | | | | 13 |
| rtc5 | #1 | #3 | #4 | |
| | -3 | -5 | 3 | |
| | 13 | -62 | 50 | |
| rtc6 | #2 | #3 | #1 | |
| | -48 | 50 | 29 | |
| | -19 | 29 | -5 | |
| ear1-r | #2 | #3 | #4 | #5 |
| | 67 | -32 | -27 | 54 |
| | -15 | -27 | 17 | -10 |
| | | | | 20 |
| ear2-r | #2 | #3 | #1 | #4 |
| | 52 | -18 | -29 | -19 |
| | 6 | 5 | 0 | 13 |
| | | | | 12 |
| ear3-r | #2 | #1 | #3 | #4 |
| | 40 | -23 | -19 | -1 |
| | -7 | 3 | -10 | 19 |
| ear4-r | #2 | #3 | #1 | #4 |
| | 31 | -11 | -11 | 3 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|----------|-----|----|-----|-----|
| | -18 | -3 | -7 | 30 |
| mrc1 *0* | #3 | #1 | #2 | #4 |
| | 2 | 24 | 16 | -52 |
| | -40 | 11 | 2 | -46 |
| mrc2 *0* | #2 | #3 | #4 | #1 |
| | 75 | -5 | -22 | 93 |
| | 37 | -3 | -14 | 23 |

NBDL GIANT: 09:17 10/13/92
35mm Still Camera System for Head Anthropometry of

Page 5
HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

| | | | | | | |
|----------|-----|-----|-----|-----|-----|-----|
| mrc3 *0* | #1 | #2 | | | | |
| | 37 | 1 | | | | |
| | -14 | -3 | | | | |
| mrc4 *0* | #1 | | | | | |
| | 95 | | | | | |
| | -17 | | | | | |
| mrc5 *0* | #1 | #3 | #2 | #4 | | |
| | 8 | -1 | -8 | -17 | | |
| | 15 | -51 | 32 | -56 | | |
| mrc6 *0* | #3 | #1 | #2 | | | |
| | 55 | 24 | -3 | | | |
| | 14 | 3 | -24 | | | |
| mcc1 *0* | #2 | #3 | #4 | #5 | #1 | #6 |
| | -13 | 0 | -17 | 5 | -13 | 47 |
| | 25 | 45 | 21 | 23 | 20 | -41 |
| mcc2 *0* | #1 | #3 | #2 | #4 | #5 | #6 |
| | -40 | 18 | -28 | 44 | 71 | 113 |
| | 4 | 45 | 76 | 85 | 45 | -25 |
| mcc3 *0* | #3 | #1 | #4 | #5 | #2 | #6 |
| | 26 | -64 | 67 | 44 | -64 | -51 |
| | 50 | 23 | 67 | 1 | -14 | 28 |
| mcc4 *0* | #1 | #3 | #2 | #4 | #5 | #6 |
| | -17 | 86 | 5 | 39 | -10 | 8 |
| | -62 | 75 | 4 | 21 | -16 | -9 |
| mcc5 *0* | #3 | #2 | #1 | #4 | #5 | |
| | -40 | -58 | -49 | -18 | 32 | |
| | 17 | -20 | -20 | -10 | -2 | |
| b | #4 | #2 | #3 | #5 | | |
| | -10 | 43 | -33 | 25 | | |
| | 23 | -35 | -4 | 14 | | |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | | | | |
|------|-----|-----|-----|-----|
| c | #3 | #2 | #5 | |
| | 65 | -59 | -39 | |
| | -16 | 24 | -9 | |
| d | #4 | #2 | #5 | |
| | 52 | -34 | -41 | |
| | -7 | 9 | 2 | |
| rtc8 | #4 | #3 | #2 | #6 |
| | 28 | 31 | -71 | -50 |
| | 0 | 19 | -32 | 15 |

NBDL GIANT: 09:17 10/13/92
 35mm Still Camera System for Head Anthropometry of

Page 6
 HRV # = 0253

| T R I A N G U L A T E D | I M A G E | P O I N T S | R E S I D U A L S |
|-------------------------|------------------|-------------|-------------------|
| | (in micrometers) | | |

| | | | | |
|----------|-----|-----|-----|-----|
| cen1 | #2 | #4 | #5 | #3 |
| | 31 | -13 | 18 | -16 |
| | -18 | 13 | 7 | -4 |
| cen3 | #4 | #5 | #2 | #6 |
| | 27 | -20 | 21 | 23 |
| | -35 | -16 | 0 | 28 |
| cen4 | #5 | #2 | #4 | #6 |
| | 10 | 47 | 0 | 25 |
| | -27 | -7 | -43 | 43 |
| cen5 | #2 | #4 | #5 | |
| | 2 | -1 | -2 | |
| | -9 | 26 | -14 | |
| cen8 | #5 | #2 | #4 | #6 |
| | -20 | 47 | -10 | 18 |
| | 8 | -19 | 32 | -16 |
| lfc5 | #3 | #4 | #5 | #2 |
| | -4 | -19 | 11 | 14 |
| | -22 | 3 | -5 | 30 |
| lfc6 | #2 | #3 | | |
| | 3 | 1 | | |
| | -15 | 15 | | |
| ron | #4 | #2 | #3 | |
| | 7 | 13 | -7 | |
| | 17 | -26 | 6 | |
| mrc8 *0* | #4 | #3 | #2 | |
| | -7 | 0 | -48 | |
| | -23 | 6 | 97 | |
| * | g | #3 | #4 | |
| | | 1 | 0 | |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | |
|------|-----------------|------------------|-----------------|
| | 28 | -28 | |
| * h | #4 -1 1 | #3 0 -1 | |
| lfc1 | #5 6 23 | #4 -11 -16 | 11 11 -12 |
| lfc2 | #5 -16 11 | #3 5 -30 | #4 12 17 |
| | | | #6 7 -2 |

NBDL GIANT: 09:17 10/13/92
 35mm Still Camera System for Head Anthropometry of Page 7
 HRV # = 0253

| TRIANGULATED | IMAGE (in micrometers) | POINTS | RESIDUALS |
|--------------|---------------------------|------------------|------------------|
| lfc3 | #5 12 28 | #4 -26 -15 | #3 24 -23 |
| lfc4 | #4 -49 6 | #5 24 -3 | #6 14 16 |
| lfc8 | #4 -58 42 | #5 -9 36 | #6 -19 -60 |
| lon | #5 1 -13 | #4 -10 11 | #3 5 1 |
| ear1-1 | #5 24 9 | #6 -47 -18 | #4 2 13 |
| ear2-1 | #5 -1 10 | #4 23 16 | #6 -17 -9 |
| ear3-1 | #5 17 0 | #4 3 30 | #3 -56 -1 |
| ear4-1 | #5 20 5 | #4 13 7 | #6 -52 -3 |
| mcc6 *0* | #3 -6 38 | | -5 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | | | | |
|----------|-----|-----|-----|-----|
| mcc8 *0* | #5 | #4 | #3 | #6 |
| | -4 | 20 | 61 | 35 |
| | -14 | -12 | 20 | -13 |
| mlc3 *0* | #4 | #3 | #5 | #6 |
| | 12 | -6 | -9 | -8 |
| | -40 | -46 | 8 | 0 |
| mlc4 *0* | #5 | #4 | #3 | #6 |
| | -41 | -1 | 35 | -5 |
| | -27 | -62 | -62 | 2 |
| mlc5 *0* | #5 | #4 | #3 | |
| | -73 | -48 | -40 | |
| | 45 | -58 | -2 | |

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35mm Still Camera System for Head Anthropometry of

Page 8
HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

| | | | | |
|----------|-----|-----|-----|----|
| mlc8 *0* | #4 | #3 | #5 | #6 |
| | -2 | 6 | -63 | 15 |
| | -70 | -29 | -72 | 61 |
| f | #4 | #5 | | |
| | -2 | 0 | | |
| | 1 | 0 | | |
| cen2 | #5 | #6 | #4 | |
| | -11 | 16 | 33 | |
| | -21 | 40 | -49 | |
| mcc7 *0* | #5 | #4 | | |
| | 74 | 54 | | |
| | -30 | 52 | | |
| mlc1 *0* | #4 | #6 | #5 | |
| | -39 | 67 | -58 | |
| | -9 | 6 | 0 | |
| mlc7 *0* | #4 | #5 | #6 | |
| | -43 | -58 | -21 | |
| | 0 | -32 | 5 | |
| mlc2 *0* | #5 | | | |
| | -17 | | | |
| | 11 | | | |

| | |
|------------------------------------|-------|
| Weighted Sum of Squares (Camera) = | 13.4 |
| Weighted Sum of Squares (Object) = | 5.9 |
| Weighted Sum of Squares (Plates) = | 138.1 |
| Weighted Sum of Squares (Total) = | 157.5 |

Anthropometry and Initial Conditions Photogrammetric Program

Degrees of Freedom..... =

281

a posteriori Variance of Unit Weight =

0.561

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 35mm Still Camera System for Head Anthropometry of Page 9
 HRV # = 0253

T R I A N G U L A T E D C A M E R A S T A T I O N S
 (Terrestrial->Ph)

| Ident | Position/Attitude | Covariance Matrix |
|-------|--|--|
| #1 | X = -0.2187 m. Y = -1.2937 m. Z = -0.7160 m. Azim. = 12 56 44.6550 Elev. = 21 48 39.6688 Swing = 114 40 31.2480 | +2.893E-05 -5.079E-07 +3.698E-06 -5.079E-07 +1.430E-05 -5.242E-06 +3.698E-06 -5.242E-06 +2.392E-05 +1.448E-05 -2.413E-06 -4.987E-06 -2.413E-06 +1.448E-05 -4.987E-06 -4.987E-06 -4.987E-06 +1.477E-05 |
| #2 | X = -0.6938 m. Y = -1.3639 m. Z = 0.2228 m. Azim. = 28 46 12.0780 Elev. = 14 33 15.9342 Swing = 124 05 54.9347 | +1.718E-05 -9.827E-07 -7.527E-07 -9.827E-07 +1.625E-05 +5.055E-06 -7.527E-07 +5.055E-06 +1.695E-05 +7.090E-06 +1.332E-06 +1.180E-06 +1.332E-06 +7.090E-06 +1.180E-06 +1.180E-06 +1.180E-06 +9.408E-06 |
| #3 | X = -0.8926 m. Y = -0.5198 m. Z = 0.7245 m. Azim. = 64 58 22.8413 Elev. = 44 39 22.8442 Swing = 157 11 4.8682 | +9.775E-06 -1.612E-07 +2.053E-07 -1.612E-07 +9.656E-06 +4.694E-07 +2.053E-07 +4.694E-07 +8.215E-06 +5.695E-06 +3.802E-07 -2.040E-07 +3.802E-07 +5.695E-06 -2.040E-07 -2.040E-07 -2.040E-07 +8.996E-06 |
| #4 | X = -0.8770 m. Y = 0.1582 m. Z = 0.7408 m. Azim. = 95 06 10.2226 Elev. = 45 59 37.3703 Swing = 177 52 29.6638 | +7.769E-06 -3.785E-08 +3.781E-07 -3.785E-08 +8.131E-06 -3.584E-07 +3.781E-07 -3.584E-07 +7.453E-06 +5.611E-06 +2.523E-07 -8.249E-08 +2.523E-07 +5.611E-06 -8.249E-08 -8.249E-08 -8.249E-08 +9.655E-06 |
| #5 | X = -0.6692 m. Y = 0.9961 m. Z = 0.3324 m. Azim. = 137 54 42.4899 Elev. = 26 20 27.0130 Swing = 135 38 8.4042 | +1.176E-05 +9.495E-07 +8.579E-07 +9.495E-07 +1.332E-05 -2.766E-06 +8.579E-07 -2.766E-06 +1.163E-05 +8.145E-06 -7.442E-07 -5.724E-07 -7.442E-07 +8.145E-06 -5.724E-07 -5.724E-07 -5.724E-07 +1.055E-05 |
| #6 | X = -0.2072 m. Y = 0.9988 m. Z = -0.5681 m. Azim. = 164 01 58.1799 Elev. = 16 05 1.2088 Swing = 111 34 39.0138 | +9.331E-06 +7.847E-08 -1.787E-06 +7.847E-08 +6.603E-06 -4.572E-07 -1.787E-06 -4.572E-07 +1.008E-05 +6.987E-06 -1.267E-06 -1.007E-06 -1.267E-06 +6.987E-06 -1.007E-06 -1.007E-06 -1.007E-06 +7.405E-06 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

SUMMARY STATISTICS FOR CAMERA STATIONS

RMS For Standard Deviations

| | | | | | |
|---------|---|-----|-----------|---------|---------------|
| Count = | 6 | X = | 0.0038 m. | Azim. = | 00 09 43.4565 |
| | | Y = | 0.0034 m. | Elev. = | 00 11 26.0755 |
| | | Z = | 0.0036 m. | Swing = | 00 10 56.5213 |

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 35mm Still Camera System for Head Anthropometry of HRV # = 0253

TRIANGULATED OBJECT POINTS

| Ident | Position (meters) | | | Covariance Matrix | Std Dev (m) |
|-------|-------------------|---------|------------|-----------------------|-------------|
| a | X = | 0.0324 | +3.124E-06 | -3.583E-07 -7.127E-07 | 0.0018 |
| | Y = | -0.0593 | -3.583E-07 | +2.895E-06 +1.427E-07 | 0.0017 |
| | Z = | -0.6096 | -7.127E-07 | +1.427E-07 +2.597E-06 | 0.0016 |
| b | X = | 0.0433 | +2.916E-06 | -7.169E-08 -7.855E-07 | 0.0017 |
| | Y = | 0.0940 | -7.169E-08 | +2.714E-06 -4.694E-08 | 0.0016 |
| | Z = | -0.6061 | -7.855E-07 | -4.694E-08 +2.745E-06 | 0.0017 |
| c | X = | 0.3055 | +3.274E-06 | +2.198E-07 -8.627E-07 | 0.0018 |
| | Y = | -0.0671 | +2.198E-07 | +2.632E-06 -3.183E-07 | 0.0016 |
| | Z = | -0.4791 | -8.627E-07 | -3.183E-07 +2.870E-06 | 0.0017 |
| d | X = | 0.3069 | +3.358E-06 | -1.059E-07 -1.023E-06 | 0.0018 |
| | Y = | 0.0869 | -1.059E-07 | +2.528E-06 +4.636E-08 | 0.0016 |
| | Z = | -0.4758 | -1.023E-06 | +4.636E-08 +2.962E-06 | 0.0017 |
| f | X = | 0.3498 | +5.384E-06 | -1.095E-06 -2.368E-06 | 0.0023 |
| | Y = | 0.2866 | -1.095E-06 | +2.267E-06 +7.869E-07 | 0.0015 |
| | Z = | -0.2119 | -2.368E-06 | +7.869E-07 +3.278E-06 | 0.0018 |
| lon | X = | -0.0109 | +8.230E-07 | -1.097E-07 -4.178E-07 | 0.0009 |
| | Y = | 0.0409 | -1.097E-07 | +4.692E-07 +7.710E-08 | 0.0007 |
| | Z = | -0.0856 | -4.178E-07 | +7.710E-08 +6.973E-07 | 0.0008 |
| ron | X = | -0.0134 | +1.067E-06 | +2.586E-07 -6.071E-07 | 0.0010 |
| | Y = | -0.0256 | +2.586E-07 | +5.706E-07 -2.152E-07 | 0.0008 |
| | Z = | -0.0856 | -6.071E-07 | -2.152E-07 +9.157E-07 | 0.0010 |
| cen1 | X = | 0.1108 | +2.326E-06 | -1.259E-08 -6.995E-07 | 0.0015 |
| | Y = | 0.1857 | -1.259E-08 | +2.020E-06 -1.671E-08 | 0.0014 |
| | Z = | -0.4690 | -6.995E-07 | -1.671E-08 +2.171E-06 | 0.0015 |
| cen2 | X = | 0.1308 | +2.350E-06 | -3.573E-07 -4.329E-07 | 0.0015 |
| | Y = | 0.1897 | -3.573E-07 | +2.701E-06 +1.774E-07 | 0.0016 |
| | Z = | -0.5119 | -4.329E-07 | +1.774E-07 +1.986E-06 | 0.0014 |
| cen3 | X = | 0.1318 | +2.302E-06 | -1.874E-07 -4.092E-07 | 0.0015 |
| | Y = | 0.2405 | -1.874E-07 | +2.565E-06 +7.776E-08 | 0.0016 |
| | Z = | -0.5091 | -4.092E-07 | +7.776E-08 +2.025E-06 | 0.0014 |
| | X = | 0.1110 | +2.000E-06 | -1.568E-07 -3.724E-07 | 0.0014 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | | | |
|------|-----|---------|------------|------------|------------|--------|
| cen4 | Y = | 0.2367 | -1.568E-07 | +2.259E-06 | +3.259E-08 | 0.0015 |
| | Z = | -0.4646 | -3.724E-07 | +3.259E-08 | +1.779E-06 | 0.0013 |
| cen5 | X = | 0.1558 | +2.555E-06 | -1.753E-07 | -8.167E-07 | 0.0016 |
| | Y = | 0.1834 | -1.753E-07 | +2.159E-06 | +1.560E-07 | 0.0015 |
| | Z = | -0.4458 | -8.167E-07 | +1.560E-07 | +2.351E-06 | 0.0015 |
| cen8 | X = | 0.1566 | +1.978E-06 | -1.953E-07 | -3.173E-07 | 0.0014 |
| | Y = | 0.2344 | -1.953E-07 | +2.136E-06 | +1.159E-08 | 0.0015 |
| | Z = | -0.4425 | -3.173E-07 | +1.159E-08 | +1.696E-06 | 0.0013 |

NBBL GIANT: 09:17 10/13/92 Page 11
 35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | | Covariance Matrix | Std Dev (m) | |
|-------|-------------------|---------|------------|-------------------|-------------|--------|
| lfc1 | X = | 0.1102 | +3.170E-06 | -7.730E-08 | -1.314E-06 | 0.0018 |
| | Y = | 0.3391 | -7.730E-08 | +2.378E-06 | +1.202E-07 | 0.0015 |
| | Z = | -0.4580 | -1.314E-06 | +1.202E-07 | +3.284E-06 | 0.0018 |
| lfc2 | X = | 0.1312 | +2.573E-06 | -1.361E-07 | -5.076E-07 | 0.0016 |
| | Y = | 0.3420 | -1.361E-07 | +2.635E-06 | +5.898E-08 | 0.0016 |
| | Z = | -0.5027 | -5.076E-07 | +5.898E-08 | +2.368E-06 | 0.0015 |
| lfc3 | X = | 0.1325 | +3.793E-06 | -4.265E-08 | -1.579E-06 | 0.0019 |
| | Y = | 0.3909 | -4.265E-08 | +2.833E-06 | +1.151E-07 | 0.0017 |
| | Z = | -0.5017 | -1.579E-06 | +1.151E-07 | +4.006E-06 | 0.0020 |
| lfc4 | X = | 0.1102 | +2.433E-06 | -7.554E-08 | -5.062E-07 | 0.0016 |
| | Y = | 0.3892 | -7.554E-08 | +2.449E-06 | -3.214E-08 | 0.0016 |
| | Z = | -0.4549 | -5.062E-07 | -3.214E-08 | +2.329E-06 | 0.0015 |
| lfc5 | X = | 0.1557 | +2.750E-06 | +7.287E-08 | -8.866E-07 | 0.0017 |
| | Y = | 0.3375 | +7.287E-08 | +2.267E-06 | -4.266E-08 | 0.0015 |
| | Z = | -0.4361 | -8.866E-07 | -4.266E-08 | +2.649E-06 | 0.0016 |
| lfc6 | X = | 0.1766 | +8.240E-06 | +6.098E-06 | -5.662E-06 | 0.0029 |
| | Y = | 0.3385 | +6.098E-06 | +1.049E-05 | -6.343E-06 | 0.0032 |
| | Z = | -0.4782 | -5.662E-06 | -6.343E-06 | +8.561E-06 | 0.0029 |
| lfc8 | X = | 0.1551 | +2.412E-06 | -1.240E-07 | -4.319E-07 | 0.0016 |
| | Y = | 0.3872 | -1.240E-07 | +2.305E-06 | -5.033E-08 | 0.0015 |
| | Z = | -0.4330 | -4.319E-07 | -5.033E-08 | +2.215E-06 | 0.0015 |
| mcc1 | X = | -0.0320 | +3.044E-08 | -8.260E-11 | -8.990E-10 | 0.0002 |
| | Y = | -0.0084 | -8.260E-11 | +3.151E-08 | -1.829E-10 | 0.0002 |
| | Z = | 0.0047 | -8.990E-10 | -1.829E-10 | +3.023E-08 | 0.0002 |
| mcc2 | X = | -0.0320 | +3.044E-08 | -9.430E-11 | -9.290E-10 | 0.0002 |
| | Y = | -0.0085 | -9.430E-11 | +3.157E-08 | -1.729E-10 | 0.0002 |
| | Z = | -0.0214 | -9.290E-10 | -1.729E-10 | +3.030E-08 | 0.0002 |
| mcc3 | X = | -0.0319 | +3.040E-08 | -1.180E-10 | -9.309E-10 | 0.0002 |
| | Y = | 0.0174 | -1.180E-10 | +3.157E-08 | -1.993E-10 | 0.0002 |
| | Z = | -0.0216 | -9.309E-10 | -1.993E-10 | +3.029E-08 | 0.0002 |

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| | | | | | | | |
|------|-----|-----|---------|------------|------------|------------|--------|
| mcc4 | *0* | X = | -0.0320 | +3.040E-08 | -1.048E-10 | -8.932E-10 | 0.0002 |
| | | Y = | 0.0174 | -1.048E-10 | +3.150E-08 | -2.313E-10 | 0.0002 |
| | | Z = | 0.0046 | -8.932E-10 | -2.313E-10 | +3.022E-08 | 0.0002 |
| mcc5 | *0* | X = | -0.0064 | +3.155E-08 | +4.584E-11 | -1.148E-09 | 0.0002 |
| | | Y = | -0.0083 | +4.584E-11 | +3.181E-08 | +3.130E-10 | 0.0002 |
| | | Z = | 0.0047 | -1.148E-09 | +3.130E-10 | +3.097E-08 | 0.0002 |
| mcc6 | *0* | X = | -0.0063 | +3.436E-08 | +3.521E-10 | -5.350E-10 | 0.0002 |
| | | Y = | -0.0084 | +3.521E-10 | +3.396E-08 | -3.236E-10 | 0.0002 |
| | | Z = | -0.0217 | -5.350E-10 | -3.236E-10 | +3.419E-08 | 0.0002 |

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 35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | | Position (meters) | Covariance Matrix | | | Std Dev (m) |
|-------|-----|-------------------|-------------------|------------|------------|-------------|
| mcc7 | *0* | X = -0.0064 | +3.345E-08 | -6.711E-10 | -8.623E-10 | 0.0002 |
| | | Y = 0.0174 | -6.711E-10 | +3.312E-08 | +4.343E-10 | 0.0002 |
| | | Z = -0.0216 | -8.623E-10 | +4.343E-10 | +3.301E-08 | 0.0002 |
| mcc8 | *0* | X = -0.0064 | +3.158E-08 | -4.633E-10 | -1.032E-09 | 0.0002 |
| | | Y = 0.0175 | -4.633E-10 | +3.177E-08 | -4.414E-10 | 0.0002 |
| | | Z = 0.0046 | -1.032E-09 | -4.414E-10 | +3.117E-08 | 0.0002 |
| mlc1 | *0* | X = 0.0298 | +3.224E-08 | -8.427E-10 | -6.180E-10 | 0.0002 |
| | | Y = 0.0316 | -8.427E-10 | +3.270E-08 | -2.143E-10 | 0.0002 |
| | | Z = 0.0051 | -6.180E-10 | -2.143E-10 | +3.187E-08 | 0.0002 |
| mlc2 | *0* | X = 0.0298 | +3.412E-08 | -5.846E-10 | -2.080E-10 | 0.0002 |
| | | Y = 0.0315 | -5.846E-10 | +3.449E-08 | +3.164E-10 | 0.0002 |
| | | Z = -0.0205 | -2.080E-10 | +3.164E-10 | +3.377E-08 | 0.0002 |
| mlc3 | *0* | X = 0.0298 | +3.176E-08 | -4.666E-10 | -9.084E-10 | 0.0002 |
| | | Y = 0.0571 | -4.666E-10 | +3.193E-08 | -4.660E-10 | 0.0002 |
| | | Z = -0.0205 | -9.084E-10 | -4.660E-10 | +3.136E-08 | 0.0002 |
| mlc4 | *0* | X = 0.0297 | +3.175E-08 | -4.734E-10 | -9.252E-10 | 0.0002 |
| | | Y = 0.0570 | -4.734E-10 | +3.185E-08 | -5.009E-10 | 0.0002 |
| | | Z = 0.0049 | -9.252E-10 | -5.009E-10 | +3.126E-08 | 0.0002 |
| mlc5 | *0* | X = 0.0548 | +3.311E-08 | -3.030E-10 | -1.195E-09 | 0.0002 |
| | | Y = 0.0316 | -3.030E-10 | +3.230E-08 | +7.522E-11 | 0.0002 |
| | | Z = 0.0050 | -1.195E-09 | +7.522E-11 | +3.230E-08 | 0.0002 |
| mlc7 | *0* | X = 0.0548 | +3.239E-08 | -7.849E-10 | -5.438E-10 | 0.0002 |
| | | Y = 0.0571 | -7.849E-10 | +3.279E-08 | -2.320E-10 | 0.0002 |
| | | Z = -0.0205 | -5.438E-10 | -2.320E-10 | +3.204E-08 | 0.0002 |
| mlc8 | *0* | X = 0.0548 | +3.191E-08 | -4.740E-10 | -8.788E-10 | 0.0002 |
| | | Y = 0.0571 | -4.740E-10 | +3.195E-08 | -4.772E-10 | 0.0002 |
| | | Z = 0.0050 | -8.788E-10 | -4.772E-10 | +3.140E-08 | 0.0002 |
| mrc1 | *0* | X = 0.0295 | +3.247E-08 | +5.335E-10 | -1.008E-09 | 0.0002 |
| | | Y = -0.0481 | +5.335E-10 | +3.230E-08 | +1.241E-10 | 0.0002 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|------|---------|---------|----------------------------------|--------|
| | Z = | 0.0045 | -1.008E-09 +1.241E-10 +3.206E-08 | 0.0002 |
| mrc2 | *0* X = | 0.0296 | +3.248E-08 +5.214E-10 -9.715E-10 | 0.0002 |
| | Y = | -0.0481 | +5.214E-10 +3.237E-08 +9.889E-11 | 0.0002 |
| | Z = | -0.0204 | -9.715E-10 +9.889E-11 +3.214E-08 | 0.0002 |
| mrc3 | *0* X = | 0.0295 | +3.352E-08 +4.497E-10 +1.193E-11 | 0.0002 |
| | Y = | -0.0237 | +4.497E-10 +3.461E-08 +2.461E-10 | 0.0002 |
| | Z = | -0.0203 | +1.193E-11 +2.461E-10 +3.352E-08 | 0.0002 |
| mrc4 | *0* X = | 0.0295 | +3.415E-08 +1.281E-10 +7.458E-11 | 0.0002 |
| | Y = | -0.0237 | +1.281E-10 +3.480E-08 +3.775E-10 | 0.0002 |
| | Z = | 0.0045 | +7.458E-11 +3.775E-10 +3.433E-08 | 0.0002 |

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 35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | Covariance Matrix | Std Dev (m) |
|-------|-------------------|---------|----------------------------------|-------------|
| mrc5 | X = | 0.0549 | +3.259E-08 +5.252E-10 -9.521E-10 | 0.0002 |
| | *0* Y = | -0.0481 | +5.252E-10 +3.239E-08 +1.225E-10 | 0.0002 |
| | Z = | 0.0045 | -9.521E-10 +1.225E-10 +3.217E-08 | 0.0002 |
| mrc6 | *0* X = | 0.0549 | +3.306E-08 +7.095E-10 -4.301E-10 | 0.0002 |
| | Y = | -0.0482 | +7.095E-10 +3.358E-08 -2.567E-11 | 0.0002 |
| | Z = | -0.0203 | -4.301E-10 -2.567E-11 +3.285E-08 | 0.0002 |
| mrc8 | *0* X = | 0.0549 | +3.333E-08 +4.665E-10 -1.126E-09 | 0.0002 |
| | Y = | -0.0238 | +4.665E-10 +3.257E-08 -2.258E-10 | 0.0002 |
| | Z = | 0.0046 | -1.126E-09 -2.258E-10 +3.268E-08 | 0.0002 |
| rtc1 | X = | 0.2427 | +1.416E-06 +5.186E-08 -4.416E-08 | 0.0012 |
| | Y = | -0.2610 | +5.186E-08 +1.498E-06 -8.627E-08 | 0.0012 |
| | Z = | -0.2899 | -4.416E-08 -8.627E-08 +1.364E-06 | 0.0012 |
| rtc2 | X = | 0.2655 | +1.645E-06 +3.787E-08 -3.115E-08 | 0.0013 |
| | Y = | -0.2598 | +3.787E-08 +1.731E-06 -1.063E-07 | 0.0013 |
| | Z = | -0.3364 | -3.115E-08 -1.063E-07 +1.546E-06 | 0.0012 |
| rtc3 | X = | 0.2670 | +1.540E-06 +2.198E-08 -2.060E-08 | 0.0012 |
| | Y = | -0.2098 | +2.198E-08 +1.645E-06 -1.063E-07 | 0.0013 |
| | Z = | -0.3358 | -2.060E-08 -1.063E-07 +1.414E-06 | 0.0012 |
| rtc4 | X = | 0.2446 | +1.311E-06 +3.896E-08 -3.290E-08 | 0.0011 |
| | Y = | -0.2103 | +3.896E-08 +1.410E-06 -8.941E-08 | 0.0012 |
| | Z = | -0.2894 | -3.290E-08 -8.941E-08 +1.233E-06 | 0.0011 |
| rtc5 | X = | 0.2899 | +1.776E-06 +9.493E-08 -1.403E-07 | 0.0013 |
| | Y = | -0.2617 | +9.493E-08 +1.698E-06 +3.421E-08 | 0.0013 |
| | Z = | -0.2681 | -1.403E-07 +3.421E-08 +1.822E-06 | 0.0013 |
| rtc6 | X = | 0.3112 | +2.191E-06 +5.082E-07 -5.069E-08 | 0.0015 |
| | Y = | -0.2623 | +5.082E-07 +2.333E-06 -1.647E-07 | 0.0015 |
| | Z = | -0.3133 | -5.069E-08 -1.647E-07 +1.855E-06 | 0.0014 |

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| | | | | | |
|--------|-------------|------------|------------|------------|--------|
| rtc8 | X = 0.2937 | +1.629E-06 | +2.014E-08 | -1.823E-07 | 0.0013 |
| | Y = -0.2114 | +2.014E-08 | +1.537E-06 | -1.577E-07 | 0.0012 |
| | Z = -0.2681 | -1.823E-07 | -1.577E-07 | +1.532E-06 | 0.0012 |
| ear1-l | X = 0.0831 | +5.635E-07 | -4.894E-08 | -9.703E-08 | 0.0008 |
| | Y = 0.1796 | -4.894E-08 | +5.613E-07 | -7.388E-08 | 0.0007 |
| | Z = -0.0902 | -9.703E-08 | -7.388E-08 | +5.144E-07 | 0.0007 |
| ear1-r | X = 0.0725 | +5.881E-07 | +1.725E-08 | -1.153E-07 | 0.0008 |
| | Y = -0.1730 | +1.725E-08 | +6.106E-07 | +3.589E-08 | 0.0008 |
| | Z = -0.1123 | -1.153E-07 | +3.589E-08 | +5.572E-07 | 0.0007 |
| ear2-l | X = 0.0752 | +5.426E-07 | -5.162E-08 | -1.011E-07 | 0.0007 |
| | Y = 0.1590 | -5.162E-08 | +5.530E-07 | -6.557E-08 | 0.0007 |
| | Z = -0.1026 | -1.011E-07 | -6.557E-08 | +4.941E-07 | 0.0007 |

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 35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | Covariance Matrix | Std Dev (m) | | |
|--------|-------------------|-------------------|-------------|------------|--------|
| ear2-r | X = 0.0653 | +5.642E-07 | +1.285E-08 | -1.145E-07 | 0.0008 |
| | Y = -0.1502 | +1.285E-08 | +5.876E-07 | +3.230E-08 | 0.0008 |
| | Z = -0.1212 | -1.145E-07 | +3.230E-08 | +5.234E-07 | 0.0007 |
| ear3-l | X = 0.0683 | +5.285E-07 | -5.445E-08 | -1.054E-07 | 0.0007 |
| | Y = 0.1377 | -5.445E-08 | +5.491E-07 | -5.835E-08 | 0.0007 |
| | Z = -0.1152 | -1.054E-07 | -5.835E-08 | +4.796E-07 | 0.0007 |
| ear3-r | X = 0.0572 | +6.725E-07 | +9.706E-08 | -1.714E-07 | 0.0008 |
| | Y = -0.1275 | +9.706E-08 | +6.311E-07 | -1.327E-08 | 0.0008 |
| | Z = -0.1294 | -1.714E-07 | -1.327E-08 | +6.013E-07 | 0.0008 |
| ear4-l | X = 0.0604 | +5.196E-07 | -5.673E-08 | -1.099E-07 | 0.0007 |
| | Y = 0.1170 | -5.673E-08 | +5.487E-07 | -5.244E-08 | 0.0007 |
| | Z = -0.1270 | -1.099E-07 | -5.244E-08 | +4.706E-07 | 0.0007 |
| ear4-r | X = 0.0494 | +6.671E-07 | +9.644E-08 | -1.787E-07 | 0.0008 |
| | Y = -0.1045 | +9.644E-08 | +6.230E-07 | -1.771E-08 | 0.0008 |
| | Z = -0.1384 | -1.787E-07 | -1.771E-08 | +5.885E-07 | 0.0008 |
| * g | X = 0.4191 | +3.957E-05 | -4.091E-06 | -4.325E-05 | 0.0063 |
| | Y = -0.3568 | -4.091E-06 | +1.175E-05 | +4.562E-06 | 0.0034 |
| | Z = -1.2174 | -4.325E-05 | +4.562E-06 | +7.604E-05 | 0.0087 |
| * h | X = 0.4381 | +4.878E-05 | +2.010E-05 | -5.626E-05 | 0.0070 |
| | Y = 0.5933 | +2.010E-05 | +2.442E-05 | -3.105E-05 | 0.0049 |
| | Z = -1.2110 | -5.626E-05 | -3.105E-05 | +9.616E-05 | 0.0098 |

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

| | | |
|------------|------------|--------|
| Count = 37 | X = 0.0021 | meters |
| Count = 37 | Y = 0.0017 | meters |

Anthropometry and Initial Conditions Photogrammetric Program

Count = 37 Z = 0.0026 meters

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 35mm Still Camera System for Head Anthropometry of HRV # = 0253

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

| | | | |
|------|---------------|------|---------------|
| | X = 0.0000 m | | X = 0.0000 m |
| mcc1 | Y = 0.0000 m | mcl1 | Y = 0.0001 m |
| | Z = 0.0001 m | | Z = 0.0000 m |
| | X = 0.0000 m | | X = 0.0000 m |
| mrc1 | Y = 0.0001 m | mcc2 | Y = -0.0001 m |
| | Z = -0.0001 m | | Z = 0.0003 m |
| | X = 0.0000 m | | X = 0.0001 m |
| mcl2 | Y = 0.0000 m | mrc2 | Y = 0.0000 m |
| | Z = 0.0000 m | | Z = -0.0001 m |
| | X = 0.0001 m | | X = 0.0000 m |
| mcc3 | Y = -0.0001 m | mcl3 | Y = 0.0000 m |
| | Z = 0.0002 m | | Z = -0.0001 m |
| | X = 0.0000 m | | X = 0.0000 m |
| mrc3 | Y = 0.0000 m | mcc4 | Y = -0.0001 m |
| | Z = 0.0000 m | | Z = 0.0000 m |
| | X = -0.0001 m | | X = 0.0000 m |
| mcl4 | Y = 0.0000 m | mrc4 | Y = 0.0000 m |
| | Z = -0.0002 m | | Z = -0.0001 m |
| | X = -0.0001 m | | X = 0.0000 m |
| mcc5 | Y = 0.0000 m | mcl5 | Y = 0.0001 m |
| | Z = 0.0001 m | | Z = -0.0001 m |
| | X = 0.0000 m | | X = 0.0000 m |
| mrc5 | Y = 0.0000 m | mcc6 | Y = 0.0000 m |
| | Z = -0.0001 m | | Z = 0.0000 m |
| | X = 0.0000 m | | X = 0.0000 m |
| mrc6 | Y = 0.0000 m | mcc7 | Y = -0.0001 m |
| | Z = 0.0000 m | | Z = 0.0001 m |
| | X = 0.0000 m | | X = 0.0000 m |
| mcl7 | Y = 0.0001 m | mcc8 | Y = -0.0001 m |
| | Z = -0.0001 m | | Z = 0.0000 m |
| | X = 0.0000 m | | X = 0.0000 m |
| mcl8 | Y = 0.0000 m | mrc8 | Y = 0.0000 m |
| | Z = -0.0001 m | | Z = 0.0001 m |

| | |
|----------------------------------|---------------------|
| X Number of Components = 22 | RMS = 0.0000 meters |
| Y Number of Components = 22 | RMS = 0.0001 meters |
| Z Number of Components = 22 | RMS = 0.0001 meters |

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35mm Still Camera System for Head Anthropometry of HRV # = 0253

A N T H R O P O M E T R Y O U T P U T

T-PLATE ORIGIN WITH RESPECT TO HEAD ANATOMICAL ORIGIN

X= 15.7009cm Y= -0.1695cm Z= -5.4439cm

T-PLATE ORIENTATION WITH RESPECT TO HEAD ANATOMICAL SYSTEM

| | | |
|-----------|----------|-----------|
| -0.508605 | 0.082581 | -0.857030 |
| -0.007191 | 0.994948 | 0.100138 |
| 0.860970 | 0.057093 | -0.505442 |

Anthropometry and Initial Conditions Photogrammetric Program

Body Anthropometry Output File

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X-Ray Determination of Body Anthropometry of Page 1
HRV # = 0253

Object Space Reference System is Rectangular

Rotation angles are Terrestrial Object-to-Photo

Complete Triangulation process is requested

Error Propagation is requested

[Eigenvector/Eigenvalue output]

Unit Variance will be based on completely free camera parameters

All Image Residuals will be listed

Triangulated Object Coordinates will be saved

Adjusted Camera Station Parameters will be saved

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X-Ray Determination of Body Anthropometry of Page 2
HRV # = 0253

ERROR WARNINGS

PASS POINTS APPEARING ON 1 PHOTO

| | | | |
|---------|-----|-----|-----|
| *Rib_Rt | *r2 | *r3 | *r4 |
| *r6 | *c7 | *c8 | |

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X-Ray Determination of Body Anthropometry of Page 3
HRV # = 0253

C A M E R A S T A T I O N S C O R R E C T I O N S

----- P O S I T I O N ----- ----- A T T I T U D E -----

| | X | Y | Z | Azim. | Elev. | Swing |
|--|---|---|---|-------|-------|-------|
|--|---|---|---|-------|-------|-------|

| | | | | | | |
|----------|---------|--------|------------|-------------|-----------|-----------|
| | | | | Iteration 1 | | |
| LfEyLfSh | 0.0025 | 0.0026 | 0.0043 m. | 0.005165 | -0.008976 | 0.009395 |
| RtEyLfSh | 0.0048 | 0.0016 | -0.0042 m. | 0.006387 | 0.007221 | -0.004892 |
| LfEyRtSh | -0.0002 | 0.0003 | -0.0015 m. | -0.000130 | -0.002379 | 0.007539 |
| RtEyRtSh | -0.0007 | 0.0005 | -0.0014 m. | -0.000203 | -0.002936 | 0.006722 |

Provisional Weighted Sum of Squares = 2007.91

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| | Iteration 2 | | | | | |
|----------|-------------|---------|-----------|-----------|-----------|-----------|
| LfEyLfSh | -0.0002 | -0.0001 | 0.0001 m. | -0.000245 | -0.000300 | 0.000168 |
| RtEyLfSh | -0.0001 | 0.0000 | 0.0000 m. | -0.000042 | 0.000029 | -0.000182 |
| LfEyRtSh | 0.0000 | -0.0001 | 0.0000 m. | 0.000029 | 0.000073 | 0.000043 |
| RtEyRtSh | 0.0000 | -0.0001 | 0.0000 m. | 0.000008 | 0.000065 | 0.000017 |

Provisional Weighted Sum of Squares = 1953.95

| | Iteration 3 | | | | | |
|----------|-------------|--------|-----------|----------|-----------|----------|
| LfEyLfSh | 0.0000 | 0.0000 | 0.0000 m. | 0.000005 | -0.000019 | 0.000019 |
| RtEyLfSh | 0.0000 | 0.0000 | 0.0000 m. | 0.000006 | 0.000010 | 0.000010 |
| LfEyRtSh | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | -0.000004 | 0.000012 |
| RtEyRtSh | 0.0000 | 0.0000 | 0.0000 m. | 0.000002 | -0.000008 | 0.000009 |

Provisional Weighted Sum of Squares = 1953.89

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HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

| | | | | |
|----------|----------|----------|----------|----------|
| Origin | LfEyLfSh | RtEyLfSh | LfEyRtSh | RtEyRtSh |
| | -840 | 738 | 1457 | -1651 |
| | -6245 | 1065 | 3951 | 1370 |
| Rib_Lf | LfEyLfSh | RtEyLfSh | LfEyRtSh | RtEyRtSh |
| | -2922 | 2985 | -754 | 620 |
| | -319 | 5515 | -3151 | -1763 |
| SpineTop | RtEyLfSh | LfEyRtSh | LfEyLfSh | RtEyRtSh |
| | -2434 | -4097 | 2648 | 4163 |
| | -2796 | 2288 | -2641 | 3347 |
| SpineBot | LfEyLfSh | RtEyLfSh | LfEyRtSh | RtEyRtSh |
| | 1913 | -1851 | -921 | 999 |
| | -2159 | -2338 | 2259 | 2391 |
| spine_bb | LfEyLfSh | RtEyLfSh | LfEyRtSh | RtEyRtSh |
| | 174 | -139 | 470 | -300 |
| | 2020 | 2154 | -2039 | -2198 |
| sternum | RtEyLfSh | LfEyLfSh | LfEyRtSh | RtEyRtSh |
| | -952 | -135 | 223 | -1040 |
| | 5370 | 3514 | -4608 | -4657 |
| *lf_shol | RtEyLfSh | LfEyLfSh | | |
| | -31 | 29 | | |
| | -217 | 216 | | |
| lneckT | RtEyLfSh | LfEyLfSh | RtEyRtSh | |
| | 943 | -987 | -121 | |
| | -1336 | 325 | 794 | |
| lneckB | LfEyLfSh | RtEyLfSh | RtEyRtSh | |
| | -776 | 794 | -48 | |
| | 411 | -717 | 237 | |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | |
|--------|----------|----------|----------|
| rneckT | LfEyLfSh | LfEyRtSh | RtEyRtSh |
| | -180 | 1000 | -1227 |
| | -2664 | 1930 | 1367 |
| rneckB | LfEyRtSh | LfEyLfSh | RtEyRtSh |
| | 1200 | 80 | -1126 |
| | 2650 | -3863 | 2151 |
| *r1 | RtEyLfSh | LfEyLfSh | |
| | -10 | 9 | |
| | -85 | 84 | |
| r2 *0* | LfEyLfSh | LfEyRtSh | RtEyRtSh |
| | -6040 | 1492 | 3314 |
| | 4211 | -4083 | -3908 |

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 X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
 (in micrometers)

| | | | | |
|--------|----------|----------|----------|----------|
| r3 *0* | LfEyRtSh | LfEyLfSh | RtEyRtSh | |
| | -141 | 6566 | -412 | |
| | -1718 | -607 | -1227 | |
| r4 *0* | LfEyLfSh | LfEyRtSh | RtEyRtSh | |
| | 5828 | 1243 | 1229 | |
| | -3163 | -132 | 94 | |
| *r5 | RtEyLfSh | LfEyLfSh | | |
| | -36 | 33 | | |
| | -293 | 290 | | |
| r6 *0* | LfEyRtSh | LfEyLfSh | RtEyRtSh | |
| | 899 | -8332 | 67 | |
| | -2349 | 7127 | -1180 | |
| r7 *0* | LfEyLfSh | RtEyLfSh | LfEyRtSh | RtEyRtSh |
| | 2531 | 3209 | 1158 | -1612 |
| | 1654 | 1369 | 579 | 1199 |
| r8 *0* | LfEyLfSh | LfEyRtSh | RtEyLfSh | RtEyRtSh |
| | 1955 | -73 | 2169 | -2293 |
| | 1003 | 2184 | 221 | 2579 |
| c1 *0* | LfEyRtSh | LfEyLfSh | RtEyLfSh | RtEyRtSh |
| | -2802 | -2426 | -1398 | -165 |
| | -2144 | 1603 | 1046 | -2066 |
| c2 *0* | RtEyLfSh | LfEyLfSh | LfEyRtSh | RtEyRtSh |
| | -1015 | -1625 | -2410 | 109 |
| | 2833 | 2865 | -1614 | -1213 |
| *c3 | LfEyLfSh | RtEyLfSh | | |
| | -1 | 1 | | |

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| | -10 | 10 | |
|-----------------------------------|------|-------|------|
| *c4 LfEyLfSh RtEyLfSh | 3 | -3 | |
| | 27 | -27 | |
| *c5 LfEyLfSh RtEyLfSh | 23 | -25 | |
| | 202 | -203 | |
| *c6 RtEyLfSh LfEyLfSh | -20 | 19 | |
| | -164 | 163 | |
| c7 *0* LfEyRtSh LfEyLfSh RtEyRtSh | 1549 | 5266 | -11 |
| | 3414 | -3835 | 3369 |

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X-Ray Determination of Body Anthropometry of

Page 6
HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

| | | | | |
|--|-------|-------|-------|-------|
| c8 *0* LfEyLfSh LfEyRtSh RtEyRtSh | 6351 | 2252 | 565 | |
| | -7500 | 5856 | 5982 | |
| 11 *0* LfEyRtSh RtEyLfSh LfEyLfSh RtEyRtSh | -1957 | -1100 | -1993 | 516 |
| | -4701 | 1073 | 2110 | -4981 |
| 12 *0* LfEyRtSh LfEyLfSh RtEyLfSh RtEyRtSh | -2089 | -830 | 27 | -126 |
| | -3692 | 1429 | 631 | -4595 |
| 13 *0* LfEyRtSh RtEyLfSh LfEyLfSh RtEyRtSh | -248 | 1449 | -2019 | -715 |
| | -941 | -3248 | -2267 | -1762 |
| 14 *0* LfEyRtSh LfEyLfSh RtEyLfSh RtEyRtSh | 2224 | -2825 | 1123 | 2073 |
| | 897 | -2620 | -3827 | 486 |
| 15 *0* LfEyLfSh RtEyLfSh LfEyRtSh RtEyRtSh | 913 | -1416 | -1608 | -1891 |
| | 4948 | 4235 | -1051 | -1803 |
| 16 *0* RtEyLfSh LfEyRtSh LfEyLfSh RtEyRtSh | -2065 | 785 | 151 | -353 |
| | 2762 | -1693 | 3150 | -2085 |
| 17 *0* LfEyLfSh LfEyRtSh RtEyLfSh RtEyRtSh | -2795 | 2695 | -1900 | -616 |
| | 158 | 1626 | -687 | 881 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | |
|----------|----------|----------|----------|----------|
| 18 *0* | LfEyLfSh | RtEyLfSh | LfEyRtSh | RtEyRtSh |
| | 408 | 1124 | 1872 | -953 |
| | 210 | -649 | 3968 | 4023 |
| Rib_Rt | RtEyRtSh | LfEyRtSh | RtEyLfSh | |
| | 175 | -565 | -71 | |
| | 6806 | 5845 | -11729 | |
| *rt_shol | RtEyRtSh | LfEyRtSh | | |
| | 13 | -14 | | |
| | -311 | 311 | | |
| r1 *0* | LfEyRtSh | RtEyRtSh | | |
| | -109 | 2134 | | |
| | -4870 | -4113 | | |
| r5 *0* | LfEyRtSh | RtEyRtSh | | |
| | -259 | -301 | | |
| | -1964 | -1193 | | |

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X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

| | | | |
|--------|----------|----------|--|
| c3 *0* | RtEyRtSh | LfEyRtSh | |
| | -923 | -1148 | |
| | -1887 | -1463 | |
| c4 *0* | RtEyRtSh | LfEyRtSh | |
| | 1345 | 926 | |
| | 2300 | 2868 | |
| c5 *0* | RtEyRtSh | LfEyRtSh | |
| | -477 | -1181 | |
| | 1753 | 1660 | |
| c6 *0* | LfEyRtSh | RtEyRtSh | |
| | -1104 | -900 | |
| | 32 | -46 | |

| | |
|------------------------------------|--------|
| Weighted Sum of Squares (Camera) = | 2.2 |
| Weighted Sum of Squares (Object) = | 118.5 |
| Weighted Sum of Squares (Plates) = | 1684.7 |
| Weighted Sum of Squares (Total) = | 1805.4 |
| Degrees of Freedom..... = | 185 |

a posteriori Variance of Unit Weight = 9.759

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NBBL GIANT: 18:02 10/08/92 Page 8
 X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D C A M E R A S T A T I O N S (Terrestrial->Ph)

| Ident | Position | Error Ellipsoid | ---> | Length |
|----------------------------------|----------------|-------------------------|---------------|-----------|
| LfEyLfSh | X = 0.5084 m. | +0.7931 +0.6089 -0.0123 | ---> | 0.0100 m. |
| | Y = -0.4485 m. | -0.4864 +0.6211 -0.6146 | ---> | 0.0079 m. |
| | Z = -0.0755 m. | +0.3666 -0.4934 -0.7888 | ---> | 0.0071 m. |
| Attitude: Azim. = 315 02 6.4341 | | | 00 51 22.2323 | |
| Elev. == 00 33 32.6112 | | Std Dev: | 00 51 22.2323 | |
| Swing = 00 27 5.6771 | | | 00 52 48.4597 | |
| RtEyLfSh | X = 0.5527 m. | +0.4902 +0.8711 -0.0279 | ---> | 0.0111 m. |
| | Y = -0.4114 m. | +0.8186 -0.4492 +0.3578 | ---> | 0.0090 m. |
| | Z = -0.0822 m. | -0.2991 +0.1983 +0.9334 | ---> | 0.0076 m. |
| Attitude: Azim. = 314 45 41.7829 | | | 00 56 14.3432 | |
| Elev. = 00 01 9.6575 | | Std Dev: | 00 56 14.3432 | |
| Swing = 01 01 21.4765 | | | 00 56 3.6139 | |
| LfEyRtSh | X = 0.5147 m. | -0.7583 +0.6506 +0.0412 | ---> | 0.0083 m. |
| | Y = 0.4702 m. | -0.6488 -0.7470 -0.1452 | ---> | 0.0073 m. |
| | Z = -0.0695 m. | +0.0636 +0.1369 -0.9885 | ---> | 0.0070 m. |
| Attitude: Azim. = 222 37 35.9298 | | | 00 42 11.5625 | |
| Elev. == 01 24 18.3679 | | Std Dev: | 00 42 11.5625 | |
| Swing == 01 14 38.0329 | | | 00 48 16.2198 | |
| RtEyRtSh | X = 0.4822 m. | +0.7947 -0.6049 -0.0513 | ---> | 0.0084 m. |
| | Y = 0.4995 m. | -0.5811 -0.7336 -0.3523 | ---> | 0.0072 m. |
| | Z = -0.0684 m. | -0.1754 -0.3098 +0.9345 | ---> | 0.0069 m. |
| Attitude: Azim. = 222 18 17.0390 | | | 00 42 31.7849 | |
| Elev. == 01 31 6.6971 | | Std Dev: | 00 42 31.7849 | |
| Swing == 01 03 31.7206 | | | 00 46 42.5383 | |

S U M M A R Y S T A T I S T I C S F O R C A M E R A S T A T I O N S

RMS For Standard Deviations

| | | |
|-----------|---------------|-----------------------|
| Count = 4 | X = 0.0087 m. | Azim. = 00 48 27.1792 |
| | Y = 0.0087 m. | Elev. = 00 52 32.7915 |
| | Z = 0.0073 m. | Swing = 00 51 5.7522 |

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 X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | Error Ellipsoid ---> | Length (m) |
|-------|-------------------|----------------------------------|------------|
| | X = -0.0307 | +9.815E-01 +1.433E-01 -1.268E-01 | 0.0007 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | | | | |
|----|-----|-----|---------|------------|------------|------------|--------|
| c1 | *0* | Y = | -0.0069 | -1.418E-01 | +9.897E-01 | +2.034E-02 | 0.0007 |
| | | Z = | 0.0019 | +1.284E-01 | -1.986E-03 | +9.917E-01 | 0.0007 |
| c2 | *0* | X = | -0.0307 | -9.866E-01 | -1.380E-01 | +8.723E-02 | 0.0007 |
| | | Y = | -0.0066 | +1.367E-01 | -9.904E-01 | -2.103E-02 | 0.0007 |
| | | Z = | -0.0189 | +8.930E-02 | -8.821E-03 | +9.960E-01 | 0.0007 |
| c3 | *0* | X = | -0.0308 | -7.457E-01 | -6.631E-01 | +6.500E-02 | 0.0008 |
| | | Y = | 0.0144 | +6.000E-01 | -6.259E-01 | +4.983E-01 | 0.0007 |
| | | Z = | -0.0226 | +2.897E-01 | -4.106E-01 | -8.646E-01 | 0.0007 |
| c4 | *0* | X = | -0.0309 | -7.446E-01 | -6.598E-01 | +1.007E-01 | 0.0008 |
| | | Y = | 0.0156 | -6.509E-01 | +6.845E-01 | -3.284E-01 | 0.0007 |
| | | Z = | 0.0022 | -1.478E-01 | +3.101E-01 | +9.392E-01 | 0.0007 |
| c5 | *0* | X = | -0.0082 | -7.134E-01 | -6.935E-01 | +1.008E-01 | 0.0008 |
| | | Y = | -0.0075 | -6.982E-01 | +6.912E-01 | -1.866E-01 | 0.0007 |
| | | Z = | 0.0023 | -5.974E-02 | +2.034E-01 | +9.773E-01 | 0.0007 |
| c6 | *0* | X = | -0.0085 | -7.147E-01 | -6.960E-01 | +6.915E-02 | 0.0008 |
| | | Y = | -0.0087 | -6.824E-01 | +6.721E-01 | -2.874E-01 | 0.0007 |
| | | Z = | -0.0199 | -1.536E-01 | +2.526E-01 | +9.553E-01 | 0.0007 |
| c7 | *0* | X = | -0.0081 | +7.933E-01 | +6.045E-01 | -7.227E-02 | 0.0008 |
| | | Y = | 0.0151 | -6.025E-01 | +7.966E-01 | +4.928E-02 | 0.0007 |
| | | Z = | -0.0208 | +8.736E-02 | +4.449E-03 | +9.962E-01 | 0.0007 |
| c8 | *0* | X = | -0.0078 | +7.914E-01 | +6.014E-01 | -1.096E-01 | 0.0008 |
| | | Y = | 0.0158 | -5.978E-01 | +7.988E-01 | +6.757E-02 | 0.0007 |
| | | Z = | 0.0018 | +1.282E-01 | +1.207E-02 | +9.917E-01 | 0.0007 |
| 11 | *0* | X = | 0.0306 | +9.205E-01 | +3.652E-01 | -1.392E-01 | 0.0007 |
| | | Y = | 0.0334 | -3.617E-01 | +9.309E-01 | +5.044E-02 | 0.0007 |
| | | Z = | 0.0037 | +1.480E-01 | +3.909E-03 | +9.890E-01 | 0.0007 |
| 12 | *0* | X = | 0.0307 | -9.164E-01 | -3.895E-01 | +9.202E-02 | 0.0007 |
| | | Y = | 0.0340 | +3.867E-01 | -9.210E-01 | -4.744E-02 | 0.0007 |
| | | Z = | -0.0197 | +1.032E-01 | -7.892E-03 | +9.946E-01 | 0.0007 |
| 13 | *0* | X = | 0.0311 | +8.569E-01 | +5.083E-01 | -8.555E-02 | 0.0007 |
| | | Y = | 0.0551 | -5.050E-01 | +8.612E-01 | +5.842E-02 | 0.0007 |
| | | Z = | -0.0200 | +1.034E-01 | -6.863E-03 | +9.946E-01 | 0.0007 |
| 14 | *0* | X = | 0.0306 | +8.619E-01 | +4.889E-01 | -1.347E-01 | 0.0007 |
| | | Y = | 0.0562 | -4.850E-01 | +8.723E-01 | +6.224E-02 | 0.0007 |
| | | Z = | 0.0037 | +1.479E-01 | +1.169E-02 | +9.889E-01 | 0.0007 |
| 15 | *0* | X = | 0.0536 | +8.464E-01 | +5.146E-01 | -1.370E-01 | 0.0007 |
| | | Y = | 0.0343 | -5.088E-01 | +8.574E-01 | +7.728E-02 | 0.0007 |
| | | Z = | 0.0027 | +1.572E-01 | +4.270E-03 | +9.876E-01 | 0.0007 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

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X-Ray Determination of Body Anthropometry of

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HRV # = 0253

TRIANGULATED OBJECT POINTS

| Ident | Position (meters) | | | Error Ellipsoid ---> | Length (m) |
|--------|-------------------|---------|----------------------------------|----------------------|------------|
| | X = | 0.0527 | -8.176E-01 -5.692E-01 +8.745E-02 | 0.0007 | |
| 16 *0* | Y = | 0.0341 | +5.649E-01 -8.222E-01 -7.000E-02 | 0.0007 | |
| | Z = | -0.0202 | +1.117E-01 -7.829E-03 +9.937E-01 | 0.0007 | |
| | X = | 0.0520 | +7.662E-01 +6.372E-01 -8.251E-02 | 0.0007 | |
| 17 *0* | Y = | 0.0556 | -6.326E-01 +7.707E-01 +7.658E-02 | 0.0007 | |
| | Z = | -0.0208 | +1.124E-01 -6.481E-03 +9.936E-01 | 0.0007 | |
| | X = | 0.0538 | +7.851E-01 +6.047E-01 -1.338E-01 | 0.0007 | |
| 18 *0* | Y = | 0.0559 | -5.988E-01 +7.963E-01 +8.560E-02 | 0.0007 | |
| | Z = | 0.0025 | +1.583E-01 +1.293E-02 +9.873E-01 | 0.0007 | |
| | X = | 0.0327 | -6.557E-01 -7.481E-01 +1.021E-01 | 0.0008 | |
| r1 *0* | Y = | -0.0468 | -7.515E-01 +6.335E-01 -1.842E-01 | 0.0007 | |
| | Z = | 0.0042 | -7.314E-02 +1.975E-01 +9.776E-01 | 0.0007 | |
| | X = | 0.0315 | +6.709E-01 +7.389E-01 -6.259E-02 | 0.0007 | |
| r2 *0* | Y = | -0.0458 | -7.341E-01 +6.737E-01 +8.462E-02 | 0.0007 | |
| | Z = | -0.0217 | +1.047E-01 -1.082E-02 +9.944E-01 | 0.0007 | |
| | X = | 0.0305 | +6.905E-01 +7.203E-01 -6.608E-02 | 0.0007 | |
| r3 *0* | Y = | -0.0245 | -7.160E-01 +6.936E-01 +7.874E-02 | 0.0007 | |
| | Z = | -0.0215 | +1.025E-01 -7.056E-03 +9.947E-01 | 0.0007 | |
| | X = | 0.0313 | +6.926E-01 +7.141E-01 -1.023E-01 | 0.0007 | |
| r4 *0* | Y = | -0.0247 | -7.048E-01 +7.000E-01 +1.148E-01 | 0.0007 | |
| | Z = | 0.0031 | +1.535E-01 -7.394E-03 +9.881E-01 | 0.0007 | |
| | X = | 0.0523 | -6.400E-01 -7.614E-01 +1.033E-01 | 0.0008 | |
| r5 *0* | Y = | -0.0460 | +6.379E-01 -4.515E-01 +6.238E-01 | 0.0007 | |
| | Z = | 0.0033 | +4.284E-01 -4.651E-01 -7.747E-01 | 0.0007 | |
| | X = | 0.0526 | +6.057E-01 +7.935E-01 -6.004E-02 | 0.0007 | |
| r6 *0* | Y = | -0.0461 | -7.879E-01 +6.085E-01 +9.457E-02 | 0.0007 | |
| | Z = | -0.0223 | +1.116E-01 -9.970E-03 +9.937E-01 | 0.0007 | |
| | X = | 0.0522 | -9.906E-01 +7.748E-02 +1.127E-01 | 0.0007 | |
| r7 *0* | Y = | -0.0235 | +7.886E-02 +9.969E-01 +7.844E-03 | 0.0007 | |
| | Z = | -0.0220 | -1.118E-01 +1.666E-02 -9.936E-01 | 0.0007 | |
| | X = | 0.0528 | -9.820E-01 -1.066E-01 +1.562E-01 | 0.0007 | |
| r8 *0* | Y = | -0.0245 | +1.016E-01 -9.940E-01 -3.942E-02 | 0.0007 | |
| | Z = | 0.0028 | +1.595E-01 -2.283E-02 +9.869E-01 | 0.0007 | |
| | X = | 0.0303 | -7.906E-01 +6.058E-01 +8.898E-02 | 0.0392 | |
| *c3 | Y = | -0.0491 | +6.104E-01 +7.913E-01 +3.602E-02 | 0.0019 | |
| | Z = | -0.0228 | +4.859E-02 -8.279E-02 +9.954E-01 | 0.0018 | |
| | X = | 0.0359 | -7.857E-01 +6.052E-01 +1.277E-01 | 0.0393 | |
| *c4 | Y = | -0.0518 | -6.130E-01 -7.344E-01 -2.913E-01 | 0.0019 | |
| | Z = | 0.0012 | +8.251E-02 +3.072E-01 -9.481E-01 | 0.0018 | |

Anthropometry and Initial Conditions Photogrammetric Program

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 X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | | Error Ellipsoid ---> | Length (m) |
|----------|-------------------|---------|------------|-----------------------|------------|
| *c5 | X = | -0.0211 | -7.770E-01 | +6.196E-01 +1.111E-01 | 0.0479 |
| | Y = | 0.0089 | -6.295E-01 | -7.632E-01 -1.461E-01 | 0.0020 |
| | Z = | -0.0001 | +5.686E-03 | +1.835E-01 -9.830E-01 | 0.0020 |
| *c6 | X = | -0.0241 | -7.790E-01 | +6.216E-01 +8.169E-02 | 0.0481 |
| | Y = | 0.0117 | -6.246E-01 | -7.581E-01 -1.877E-01 | 0.0020 |
| | Z = | -0.0208 | +5.477E-02 | +1.973E-01 -9.788E-01 | 0.0020 |
| *r1 | X = | -0.0025 | -7.803E-01 | +6.146E-01 +1.157E-01 | 0.0444 |
| | Y = | -0.0116 | -5.988E-01 | -6.808E-01 -4.220E-01 | 0.0019 |
| | Z = | 0.0000 | +1.806E-01 | +3.986E-01 -8.992E-01 | 0.0019 |
| *r5 | X = | -0.0043 | -7.650E-01 | +6.340E-01 +1.133E-01 | 0.0461 |
| | Y = | 0.0123 | -6.436E-01 | -7.455E-01 -1.734E-01 | 0.0019 |
| | Z = | 0.0002 | +2.548E-02 | +2.056E-01 -9.783E-01 | 0.0019 |
| Origin | X = | 0.1667 | +1.696E-01 | +9.855E-01 +9.441E-03 | 0.0027 |
| | Y = | 0.0054 | -9.854E-01 | +1.694E-01 +1.891E-02 | 0.0022 |
| | Z = | -0.0751 | +1.704E-02 | -1.251E-02 +9.998E-01 | 0.0017 |
| Rib_Lf | X = | 0.1409 | +1.751E-01 | +9.844E-01 +1.807E-02 | 0.0024 |
| | Y = | 0.0370 | -9.845E-01 | +1.748E-01 +1.329E-02 | 0.0021 |
| | Z = | -0.0784 | +9.927E-03 | -2.012E-02 +9.997E-01 | 0.0016 |
| Rib_Rt | X = | 0.1447 | +4.646E-01 | +8.855E-01 +2.799E-03 | 0.0030 |
| | Y = | -0.0192 | +8.855E-01 | -4.646E-01 +1.504E-03 | 0.0022 |
| | Z = | -0.0759 | +2.633E-03 | +1.780E-03 -1.000E+00 | 0.0018 |
| lneckB | X = | -0.0451 | +9.969E-01 | -5.515E-02 +5.554E-02 | 0.0032 |
| | Y = | 0.1152 | +5.130E-02 | +9.963E-01 +6.852E-02 | 0.0027 |
| | Z = | -0.0984 | -5.912E-02 | -6.546E-02 +9.961E-01 | 0.0021 |
| lneckT | X = | -0.0458 | -9.968E-01 | +5.720E-02 +5.556E-02 | 0.0031 |
| | Y = | 0.1179 | -5.829E-02 | -9.981E-01 -1.821E-02 | 0.0026 |
| | Z = | -0.0348 | +5.442E-02 | -2.139E-02 +9.983E-01 | 0.0020 |
| rneckB | X = | -0.0397 | +9.019E-01 | +4.276E-01 +6.137E-02 | 0.0031 |
| | Y = | -0.0949 | -4.259E-01 | +9.039E-01 -3.969E-02 | 0.0025 |
| | Z = | -0.1014 | -7.244E-02 | +9.657E-03 +9.973E-01 | 0.0021 |
| rneckT | X = | -0.0396 | +8.963E-01 | +4.410E-01 -4.694E-02 | 0.0030 |
| | Y = | -0.0943 | -4.399E-01 | +8.975E-01 +3.257E-02 | 0.0024 |
| | Z = | -0.0381 | +5.649E-02 | -8.540E-03 +9.984E-01 | 0.0019 |
| sternum | X = | 0.1819 | -1.622E-01 | -9.866E-01 -1.854E-02 | 0.0031 |
| | Y = | -0.0004 | -9.776E-01 | +1.632E-01 -1.328E-01 | 0.0025 |
| | Z = | -0.1312 | -1.340E-01 | +3.408E-03 +9.910E-01 | 0.0020 |
| *lf_shol | X = | -0.0256 | +6.997E-01 | -7.054E-01 +1.127E-01 | 0.0690 |
| | Y = | 0.1266 | -6.911E-01 | -7.084E-01 -1.432E-01 | 0.0032 |
| | Z = | -0.1676 | -1.809E-01 | -2.232E-02 +9.832E-01 | 0.0030 |

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 X-Ray Determination of Body Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | | Error Ellipsoid ---> | Length (m) | |
|----------|-------------------|---------|------------|----------------------|------------|--------|
| *rt_shol | X = | -0.0638 | +6.507E-01 | +7.482E-01 | +1.297E-01 | 0.1109 |
| | Y = | -0.1608 | -7.291E-01 | +6.633E-01 | -1.684E-01 | 0.0034 |
| | Z = | -0.1809 | +2.120E-01 | -1.502E-02 | -9.771E-01 | 0.0033 |
| SpineBot | X = | 0.0915 | +1.834E-01 | +9.830E-01 | +6.529E-03 | 0.0021 |
| | Y = | -0.0002 | +9.830E-01 | -1.833E-01 | -6.239E-03 | 0.0020 |
| | Z = | -0.0771 | -4.936E-03 | +7.563E-03 | -1.000E+00 | 0.0015 |
| SpineTop | X = | 0.0974 | +1.730E-01 | +9.849E-01 | +4.707E-03 | 0.0021 |
| | Y = | -0.0016 | -9.847E-01 | +1.729E-01 | +2.196E-02 | 0.0020 |
| | Z = | -0.0703 | -2.082E-02 | +8.434E-03 | -9.997E-01 | 0.0015 |
| spine_bb | X = | 0.0591 | +6.670E-01 | +7.450E-01 | -2.066E-03 | 0.0019 |
| | Y = | 0.0043 | -7.448E-01 | +6.669E-01 | +2.026E-02 | 0.0019 |
| | Z = | -0.0683 | -1.647E-02 | +1.198E-02 | -9.998E-01 | 0.0014 |

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

| | | |
|------------|-----|---------------|
| Count = 19 | X = | 0.0279 meters |
| Count = 19 | Y = | 0.0270 meters |
| Count = 19 | Z = | 0.0050 meters |

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 X-Ray Determination of Body Anthropometry of HRV # = 0253

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

| | | | |
|----|---------------|----|---------------|
| c1 | X = 0.0000 m | | X = 0.0001 m |
| | Y = 0.0004 m | 11 | Y = 0.0004 m |
| | Z = 0.0001 m | | Z = 0.0005 m |
| r1 | X = 0.0002 m | | X = 0.0000 m |
| | Y = 0.0000 m | c2 | Y = 0.0003 m |
| | Z = 0.0007 m | | Z = -0.0002 m |
| 12 | X = -0.0001 m | | X = 0.0006 m |
| | Y = 0.0002 m | r2 | Y = 0.0002 m |
| | Z = 0.0005 m | | Z = 0.0002 m |
| c3 | X = -0.0001 m | | X = 0.0000 m |
| | Y = 0.0001 m | 13 | Y = 0.0001 m |
| | Z = 0.0002 m | | Z = 0.0006 m |
| r3 | X = -0.0004 m | | X = 0.0001 m |
| | Y = -0.0004 m | c4 | Y = -0.0002 m |
| | Z = 0.0003 m | | Z = -0.0004 m |

Anthropometry and Initial Conditions Photogrammetric Program

| | | |
|----|---|--|
| 14 | X = 0.0004 m Y = -0.0002 m Z = 0.0004 m | r4 X = -0.0002 m Y = -0.0005 m Z = 0.0003 m |
| c5 | X = -0.0001 m Y = 0.0001 m Z = -0.0003 m | 15 X = -0.0002 m Y = 0.0003 m Z = -0.0005 m |
| r5 | X = 0.0000 m Y = 0.0000 m Z = 0.0002 m | c6 X = -0.0001 m Y = 0.0001 m Z = 0.0000 m |
| 16 | X = 0.0001 m Y = 0.0001 m Z = -0.0001 m | r6 X = 0.0005 m Y = 0.0006 m Z = -0.0003 m |
| c7 | X = -0.0002 m Y = -0.0004 m Z = -0.0002 m | 17 X = 0.0004 m Y = 0.0001 m Z = -0.0002 m |
| r7 | X = -0.0004 m Y = -0.0003 m Z = -0.0004 m | c8 X = -0.0002 m Y = -0.0006 m Z = -0.0003 m |
| 18 | X = -0.0001 m Y = -0.0002 m Z = -0.0007 m | r8 X = -0.0004 m Y = -0.0002 m Z = -0.0005 m |

| | |
|----------------------------------|---------------------|
| X Number of Components = 24 | RMS = 0.0003 meters |
| Y Number of Components = 24 | RMS = 0.0003 meters |
| Z Number of Components = 24 | RMS = 0.0004 meters |

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 X-Ray Determination of Body Anthropometry of HRV # = 0253

A N T H R O P O M E T R Y O U T P U T

T-PLATE ORIGIN WITH RESPECT TO BODY ANATOMICAL ORIGIN

X= -16.8052cm Y= 0.6003cm Z= 7.2123cm

T-PLATE ORIENTATION WITH RESPECT TO BODY ANATOMICAL SYSTEM

| | | |
|-----------|-----------|----------|
| 0.995966 | -0.088285 | 0.016067 |
| 0.087475 | 0.995123 | 0.045594 |
| -0.020014 | -0.044004 | 0.998831 |

Site Survey Output File

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 1

Object Space Reference System is Rectangular
Rotation angles are Terrestrial Object-to-Photo
Complete Triangulation process is requested
Error Propagation is requested
[Variance/Covariance output]

Unit Variance will be based on completely free camera parameters
All Image Residuals will be listed
Triangulated Object Coordinates will not be saved
Adjusted Camera Station Parameters will be saved

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 2

E R R O R W A R N I N G S

POINTS NOT PHOTOGRAPHED

rtc5

PASS POINTS APPEARING ON 1 PHOTO

| | | | |
|-------|-------|-------|-------|
| xc6 | xc | xx+24 | c6 |
| xz+12 | yx+24 | Xy-06 | Xlfc4 |
| lfc7 | | | |

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

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C A M E R A S T A T I O N S C O R R E C T I O N S
----- P O S I T I O N ----- ----- A T T I T U D E -----

| | X | Y | Z | Azim. | Elev. | Swing |
|----|---------|---------|-----------|-------------|-----------|-----------|
| | | | | Iteration 1 | | |
| #1 | -0.0002 | -0.0001 | 0.0002 m. | -0.000049 | -0.000150 | 0.000101 |
| #2 | 0.0001 | -0.0003 | 0.0006 m. | -0.000029 | -0.000243 | 0.000189 |
| #3 | -0.0005 | 0.0001 | 0.0001 m. | -0.000198 | -0.000117 | 0.000093 |
| #4 | -0.0003 | 0.0000 | 0.0003 m. | -0.000156 | 0.000571 | -0.000648 |
| #5 | -0.0006 | 0.0005 | 0.0001 m. | -0.000106 | 0.000123 | -0.000365 |
| #6 | -0.0006 | 0.0000 | 0.0002 m. | -0.000126 | -0.000143 | -0.000197 |

Provisional Weighted Sum of Squares = 679.576

| | X | Y | Z | Iteration 2 | | |
|----|--------|--------|-----------|-------------|-----------|-----------|
| #1 | 0.0000 | 0.0000 | 0.0000 m. | -0.000001 | 0.000000 | -0.000002 |
| #2 | 0.0000 | 0.0000 | 0.0000 m. | -0.000004 | 0.000001 | 0.000001 |
| #3 | 0.0000 | 0.0000 | 0.0000 m. | -0.000002 | -0.000003 | 0.000003 |
| #4 | 0.0000 | 0.0000 | 0.0000 m. | -0.000001 | -0.000002 | 0.000001 |
| #5 | 0.0000 | 0.0000 | 0.0000 m. | 0.000001 | -0.000002 | 0.000002 |
| #6 | 0.0000 | 0.0000 | 0.0000 m. | 0.000003 | -0.000001 | 0.000001 |

Provisional Weighted Sum of Squares = 625.981

| | X | Y | Z | Iteration 3 | | |
|----|--------|--------|-----------|-------------|----------|----------|
| #1 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |
| #2 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |
| #3 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |
| #4 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |
| #5 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |
| #6 | 0.0000 | 0.0000 | 0.0000 m. | 0.000000 | 0.000000 | 0.000000 |

Provisional Weighted Sum of Squares = 625.954

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

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| T R I A N G U L A T E D | I M A G E | P O I N T S | R E S I D U A L S | | | |
|-------------------------|------------------|----------------|-------------------|---------------|---------------|-----------------|
| | (in micrometers) | | | | | |
| lfc1 | #1 0 -1 | #2 8 -12 | #3 -15 9 | #4 -6 9 | #5 12 4 | #6 -17 -8 |
| lfc3 | #1 17 8 | #2 2 -11 | #3 -5 -11 | #4 -9 1 | #5 27 0 | #6 -4 6 |
| lfc4 | #2 1 -4 | #1 6 2 | #3 -6 -4 | #4 6 0 | #5 3 4 | |

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| | | | | | | |
|----------|-----|-----|-----|-----|-----|----|
| lfc6 | #3 | #1 | #6 | | | |
| | -22 | 14 | -3 | | | |
| | 9 | 15 | -16 | | | |
| c1 | #2 | #3 | #4 | #1 | #5 | #6 |
| | 2 | 12 | 3 | -7 | 0 | 0 |
| | -13 | -2 | -4 | -5 | 15 | 4 |
| c2 | #2 | #4 | #5 | #1 | #6 | |
| | 21 | -3 | 4 | -1 | 7 | |
| | -3 | 1 | 9 | -6 | -3 | |
| c3 | #1 | #2 | #3 | #4 | #5 | #6 |
| | -6 | 12 | 14 | 0 | -1 | 14 |
| | -1 | -2 | -10 | -6 | 5 | 9 |
| c4 | #2 | #1 | #3 | #4 | #5 | #6 |
| | 10 | -13 | 17 | 0 | -15 | 15 |
| | -3 | -5 | 9 | 0 | -4 | 4 |
| c5 | #1 | #3 | #2 | #4 | #5 | |
| | -3 | 1 | 0 | -1 | 0 | |
| | 1 | -6 | 4 | -6 | 6 | |
| c7 | #4 | #1 | #5 | #6 | | |
| | 5 | 18 | 3 | 0 | | |
| | 9 | -11 | 17 | -15 | | |
| a | #2 | #3 | #4 | #5 | #1 | |
| | 22 | -22 | 9 | 6 | -21 | |
| | -10 | -26 | -3 | 25 | 21 | |
| b | #2 | #3 | #1 | #4 | #5 | |
| | 32 | -27 | -26 | 4 | 12 | |
| | -6 | -33 | 20 | 8 | 16 | |
| rtc1 *0* | #1 | #3 | #4 | #2 | #5 | |
| | 4 | -23 | 4 | 4 | -7 | |
| | -8 | -9 | 1 | 0 | -10 | |

NBBL GIANT: 15:15 03/25/92
azimuth - elevation - swing

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| TRIANGULATED | IMAGE | POINTS | RESIDUALS |
|--------------|------------------|--------|-----------|
| | (in micrometers) | | |

| | | | | |
|----------|-----|-----|-----|----|
| rtc2 *0* | #3 | #2 | #1 | #6 |
| | -11 | -16 | 2 | 4 |
| | 32 | 19 | -21 | 12 |
| rtc3 *0* | #4 | #1 | #5 | #6 |
| | 8 | -3 | -7 | 19 |
| | -5 | 19 | -8 | -2 |
| rtc6 *0* | #1 | #2 | | |
| | -15 | -30 | | |

Anthropometry and Initial Conditions Photogrammetric Program

| | 7 | 19 | | | | |
|----------|------------------|------------------|------------------|-----------------|------------------|-----------------|
| rtc7 *0* | #1 -36 -34 | | | | | |
| sp1 *0* | #3 0 4 | #4 0 -11 | #5 -9 -9 | #1 0 -6 | #2 -15 -10 | #6 -16 0 |
| sp2 *0* | #4 -3 -13 | #2 -20 13 | #5 -21 -15 | #1 8 -16 | #3 6 2 | #6 0 14 |
| sp3 *0* | #2 -16 10 | #3 9 -2 | #4 1 -4 | #5 -14 -8 | #1 2 0 | #6 -2 0 |
| sp4 *0* | #1 15 -7 | #2 3 5 | #4 8 -12 | #3 0 13 | #5 -12 -13 | #6 -5 -2 |
| x+12 *0* | #4 -1 -18 | #1 24 15 | #5 29 -12 | #2 48 -28 | #3 10 -13 | #6 -9 1 |
| x+18 *0* | #4 -21 -6 | #1 -4 9 | #2 19 2 | #5 30 0 | #3 17 -19 | #6 -11 0 |
| y+12 *0* | #4 8 -1 | #1 -7 -9 | #3 10 -4 | #5 -6 7 | #2 12 -3 | #6 -3 -38 |
| y+06 *0* | #3 27 -13 | #4 5 15 | #1 10 -10 | #5 5 0 | #2 10 0 | #6 5 -1 |
| y-06 *0* | #1 -5 -6 | #2 -19 -20 | #4 -4 14 | #6 0 1 | | |

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azimuth - elevation - swing

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| TRIANGULATED | IMAGE POINTS (in micrometers) | | | RESIDUALS | | |
|--------------|----------------------------------|----------------|----------------|-----------------|----------------|----------------|
| z+06 *0* | #3 8 18 | #5 -31 3 | #1 12 7 | #2 -4 -14 | #4 -3 21 | #6 -4 33 |
| z+12 *0* | #2 -17 -21 | #1 17 25 | #4 -23 3 | #6 -19 38 | | |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | | | | | |
|----------|------------------|-----------------|-----------------|------------------|-----------------|
| lfc2 | #3 -2 -2 | #5 4 27 | #6 -2 -30 | #2 23 -2 | #4 -14 12 |
| lfc5 | #3 5 -1 | #5 2 -7 | #4 -7 8 | #2 -1 1 | |
| c8 | #4 -1 1 | #2 0 -3 | #6 13 0 | #3 15 5 | #5 -10 -2 |
| d | #4 5 -19 | #6 2 6 | #3 0 22 | #5 -27 -18 | #2 -35 15 |
| e | #2 -36 25 | #3 -4 0 | #6 3 37 | #5 -11 -41 | #4 6 -15 |
| rtc4 *0* | #5 -11 -12 | #3 5 -1 | #2 0 21 | #6 2 -3 | #4 7 -15 |
| rtc8 *0* | #2 5 20 | | | | |
| x+06 *0* | #5 -14 -9 | #3 13 -14 | #2 10 -9 | #4 -16 -19 | #6 -15 0 |
| x+24 *0* | #3 -14 40 | #6 48 0 | #2 -33 23 | #4 24 41 | |
| lfc8 | #3 -17 10 | #6 -10 0 | #5 3 -7 | | |
| c | #5 17 9 | #6 -4 12 | #4 -1 -18 | | |

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

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| | TRIANGULATED | IMAGE | POINTS | RESIDUALS |
|----------|------------------|-----------------|----------------|-----------|
| | (in micrometers) | | | |
| y-12 *0* | #4 9 32 | #6 -1 -25 | #5 42 -6 | |
| g | #6 -2 | #5 -2 | | |

Anthropometry and Initial Conditions Photogrammetric Program

| | | |
|---|-----|----|
| | -16 | 16 |
| h | #6 | #5 |
| | -2 | -2 |
| | -19 | 17 |
| i | #6 | #5 |
| | 0 | 0 |
| | -3 | 3 |

| | |
|------------------------------------|-------|
| Weighted Sum of Squares (Camera) = | 0.0 |
| Weighted Sum of Squares (Object) = | 107.0 |
| Weighted Sum of Squares (Plates) = | 206.4 |
| Weighted Sum of Squares (Total) = | 313.5 |
| Degrees of Freedom..... = | 286 |

| | |
|--|-------|
| a posteriori Variance of Unit Weight = | 1.096 |
|--|-------|

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

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T R I A N G U L A T E D C A M E R A S T A T I O N S
(Terrestrial->Ph)

| Ident | Position/Attitude | Covariance Matrix |
|-------|--|--|
| #1 | X = -0.4202 m. Y = -1.2981 m. Z = 0.9382 m. Azim. = 19 50 43.9750 Elev. == 28 07 18.6050 Swing = 04 19 19.1519 | +4.621E-06 -4.300E-07 +7.299E-07 -4.300E-07 +3.703E-06 +3.339E-07 +7.299E-07 +3.339E-07 +5.628E-06 +1.680E-06 -2.153E-07 -3.530E-07 -2.153E-07 +1.680E-06 -3.530E-07 -3.530E-07 -3.530E-07 +1.426E-06 |
| #2 | X = 0.9591 m. Y = -1.2663 m. Z = 0.9626 m. Azim. = 332 52 40.0853 Elev. == 29 29 36.4430 Swing == 01 57 52.1536 | +5.169E-06 +1.535E-06 -8.687E-07 +1.535E-06 +4.188E-06 +6.254E-07 -8.687E-07 +6.254E-07 +5.765E-06 +1.844E-06 +1.201E-08 -3.896E-07 +1.201E-08 +1.844E-06 -3.896E-07 -3.896E-07 -3.896E-07 +1.152E-06 |
| #3 | X = 1.8605 m. Y = -0.3919 m. Z = 0.9121 m. Azim. = 299 35 47.0441 Elev. == 28 25 56.5311 Swing = 00 54 35.2447 | +4.568E-06 +1.157E-06 +1.433E-06 +1.157E-06 +5.927E-06 +2.108E-07 +1.433E-06 +2.108E-07 +1.063E-05 +1.616E-06 +2.794E-07 -7.710E-07 +2.794E-07 +1.616E-06 -7.710E-07 -7.710E-07 -7.710E-07 +3.511E-06 |
| #4 | X = 1.8857 m. Y = 1.1240 m. Z = 0.8633 m. Azim. = 246 54 29.5476 Elev. == 26 20 3.8353 Swing == 01 42 27.3195 | +5.353E-06 -2.966E-06 -1.193E-06 -2.966E-06 +1.203E-05 +1.526E-06 -1.193E-06 +1.526E-06 +1.123E-05 +2.624E-06 +4.737E-07 -1.147E-07 +4.737E-07 +2.624E-06 -1.147E-07 -1.147E-07 -1.147E-07 +3.989E-06 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | | | | | |
|----------|---------------|----------------|------------|------------|------------|
| #5 | X = | 1.0024 m. | +1.243E-05 | -2.054E-06 | +1.176E-06 |
| | Y = | 2.0435 m. | -2.054E-06 | +6.210E-06 | -9.771E-07 |
| | Z = | 0.8161 m. | +1.176E-06 | -9.771E-07 | +1.148E-05 |
| | Azim. = | 202 03 15.2619 | +2.350E-06 | +2.642E-07 | +3.948E-07 |
| | Elev. == | 26 10 27.3019 | +2.642E-07 | +2.350E-06 | +3.948E-07 |
| Swing == | 02 24 9.5880 | +3.948E-07 | +3.948E-07 | +1.804E-06 | |
| #6 | X = | -0.3616 m. | +6.813E-06 | +7.454E-07 | +5.804E-07 |
| | Y = | 2.0920 m. | +7.454E-07 | +5.103E-06 | -2.669E-07 |
| | Z = | 0.7872 m. | +5.804E-07 | -2.669E-07 | +8.967E-06 |
| | Azim. = | 158 34 26.3098 | +1.428E-06 | +1.194E-07 | +2.166E-07 |
| | Elev. == | 22 25 15.6254 | +1.194E-07 | +1.428E-06 | +2.166E-07 |
| Swing == | 00 11 47.8227 | +2.166E-07 | +2.166E-07 | +1.300E-06 | |

SUMMARY STATISTICS FOR CAMERA STATIONS

RMS For Standard Deviations

| | | | | |
|-----------|-----|-----------|---------|---------------|
| Count = 6 | X = | 0.0025 m. | Azim. = | 00 04 46.0957 |
| | Y = | 0.0025 m. | Elev. = | 00 06 10.0783 |
| | Z = | 0.0030 m. | Swing = | 00 05 5.7246 |

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azimuth - elevation - swing

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TRIANGULATED OBJECT POINTS

| Ident | Position (meters) | | Covariance Matrix | Std Dev (m) |
|-------|-------------------|---------|----------------------------------|-------------|
| a | X = | 0.2977 | +2.299E-07 +9.901E-09 +4.550E-08 | 0.0005 |
| | Y = | 0.0099 | +9.901E-09 +2.498E-07 -3.700E-08 | 0.0005 |
| | Z = | -0.0707 | +4.550E-08 -3.700E-08 +2.204E-07 | 0.0005 |
| b | X = | 0.2988 | +2.460E-07 +1.038E-08 +5.062E-08 | 0.0005 |
| | Y = | 0.0088 | +1.038E-08 +2.727E-07 -3.958E-08 | 0.0005 |
| | Z = | -0.1351 | +5.062E-08 -3.958E-08 +2.423E-07 | 0.0005 |
| c | X = | 0.5555 | +7.041E-07 +2.934E-07 +2.662E-07 | 0.0008 |
| | Y = | 0.0766 | +2.934E-07 +1.328E-06 +5.841E-07 | 0.0012 |
| | Z = | -0.3266 | +2.662E-07 +5.841E-07 +9.724E-07 | 0.0010 |
| d | X = | 0.2991 | +8.934E-07 -3.066E-08 +1.136E-07 | 0.0009 |
| | Y = | 0.7227 | -3.066E-08 +9.283E-07 +1.612E-07 | 0.0010 |
| | Z = | -0.1620 | +1.136E-07 +1.612E-07 +9.815E-07 | 0.0010 |
| e | X = | 0.2996 | +8.979E-07 -1.685E-08 +1.165E-07 | 0.0009 |
| | Y = | 0.7200 | -1.685E-08 +9.408E-07 +1.944E-07 | 0.0010 |
| | Z = | -0.2236 | +1.165E-07 +1.944E-07 +1.003E-06 | 0.0010 |
| g | X = | 0.0549 | +2.085E-06 +8.680E-07 +4.311E-07 | 0.0014 |
| | Y = | -0.9181 | +8.680E-07 +2.233E-05 +6.122E-06 | 0.0047 |
| | Z = | -0.2093 | +4.311E-07 +6.122E-06 +4.159E-06 | 0.0020 |
| h | X = | 0.6597 | +2.644E-06 -2.287E-06 -2.968E-07 | 0.0016 |
| | Y = | -1.0184 | -2.287E-06 +2.439E-05 +5.651E-06 | 0.0049 |
| | Z = | -0.0603 | -2.968E-07 +5.651E-06 +4.248E-06 | 0.0021 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | | | |
|----|-----|---------|------------|------------|------------|--------|
| i | X = | 0.8362 | +3.492E-06 | -4.007E-06 | -1.737E-06 | 0.0019 |
| | Y = | -0.6713 | -4.007E-06 | +2.451E-05 | +1.099E-05 | 0.0050 |
| | Z = | -0.7043 | -1.737E-06 | +1.099E-05 | +8.327E-06 | 0.0029 |
| c1 | X = | 0.0701 | +6.973E-07 | -1.521E-08 | +5.814E-08 | 0.0008 |
| | Y = | 0.6693 | -1.521E-08 | +7.332E-07 | +2.923E-08 | 0.0009 |
| | Z = | 0.0204 | +5.814E-08 | +2.923E-08 | +7.703E-07 | 0.0009 |
| c2 | X = | 0.0197 | +6.996E-07 | +1.284E-08 | +5.225E-08 | 0.0008 |
| | Y = | 0.6681 | +1.284E-08 | +7.990E-07 | +4.640E-08 | 0.0009 |
| | Z = | 0.0200 | +5.225E-08 | +4.640E-08 | +7.899E-07 | 0.0009 |
| c3 | X = | 0.0181 | +7.698E-07 | -1.455E-08 | +5.823E-08 | 0.0009 |
| | Y = | 0.7182 | -1.455E-08 | +7.890E-07 | +3.849E-08 | 0.0009 |
| | Z = | 0.0163 | +5.823E-08 | +3.849E-08 | +8.665E-07 | 0.0009 |
| c4 | X = | 0.0682 | +7.794E-07 | -2.070E-08 | +6.250E-08 | 0.0009 |
| | Y = | 0.7196 | -2.070E-08 | +8.027E-07 | +3.957E-08 | 0.0009 |
| | Z = | 0.0166 | +6.250E-08 | +3.957E-08 | +8.691E-07 | 0.0009 |
| c5 | X = | 0.0706 | +7.813E-07 | +9.717E-09 | +9.401E-08 | 0.0009 |
| | Y = | 0.6656 | +9.717E-09 | +7.551E-07 | +3.135E-08 | 0.0009 |
| | Z = | -0.0303 | +9.401E-08 | +3.135E-08 | +8.187E-07 | 0.0009 |

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azimuth - elevation - swing

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T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | | Covariance Matrix | Std Dev (m) | |
|---------|-------------------|---------|------------|-------------------|-------------|--------|
| c7 | X = | 0.0190 | +8.134E-07 | +5.276E-08 | +7.591E-08 | 0.0009 |
| | Y = | 0.7157 | +5.276E-08 | +9.010E-07 | +1.313E-07 | 0.0009 |
| | Z = | -0.0337 | +7.591E-08 | +1.313E-07 | +9.307E-07 | 0.0010 |
| c8 | X = | 0.0688 | +8.108E-07 | -1.775E-08 | +7.721E-08 | 0.0009 |
| | Y = | 0.7164 | -1.775E-08 | +8.125E-07 | +9.019E-08 | 0.0009 |
| | Z = | -0.0336 | +7.721E-08 | +9.019E-08 | +8.989E-07 | 0.0009 |
| sp1 *0* | X = | 0.0252 | +1.039E-07 | +6.685E-10 | +9.451E-09 | 0.0003 |
| | Y = | -0.0252 | +6.685E-10 | +1.210E-07 | -9.075E-09 | 0.0003 |
| | Z = | 0.0259 | +9.451E-09 | -9.075E-09 | +9.794E-08 | 0.0003 |
| sp2 *0* | X = | -0.0256 | +1.060E-07 | +2.951E-10 | +9.440E-09 | 0.0003 |
| | Y = | -0.0250 | +2.951E-10 | +1.239E-07 | -9.308E-09 | 0.0004 |
| | Z = | 0.0256 | +9.440E-09 | -9.308E-09 | +1.007E-07 | 0.0003 |
| sp3 *0* | X = | -0.0255 | +1.061E-07 | +2.216E-10 | +9.460E-09 | 0.0003 |
| | Y = | 0.0254 | +2.216E-10 | +1.253E-07 | -8.661E-09 | 0.0004 |
| | Z = | 0.0255 | +9.460E-09 | -8.661E-09 | +9.997E-08 | 0.0003 |
| sp4 *0* | X = | 0.0249 | +1.039E-07 | +4.784E-10 | +9.529E-09 | 0.0003 |
| | Y = | 0.0253 | +4.784E-10 | +1.224E-07 | -8.430E-09 | 0.0003 |
| | Z = | 0.0256 | +9.529E-09 | -8.430E-09 | +9.729E-08 | 0.0003 |
| lfc1 | X = | 0.0653 | +9.585E-07 | -3.486E-08 | +7.054E-08 | 0.0010 |
| | Y = | 0.8193 | -3.486E-08 | +9.462E-07 | +6.130E-08 | 0.0010 |

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

| | | | | | | |
|------|-----|---------|------------|------------|------------|--------|
| | Z = | 0.0114 | +7.054E-08 | +6.130E-08 | +1.086E-06 | 0.0010 |
| lfc2 | X = | 0.0152 | +9.840E-07 | -2.798E-08 | +7.667E-08 | 0.0010 |
| | Y = | 0.8187 | -2.798E-08 | +9.445E-07 | +7.842E-08 | 0.0010 |
| | Z = | 0.0111 | +7.667E-08 | +7.842E-08 | +1.113E-06 | 0.0011 |
| lfc3 | X = | 0.0145 | +1.044E-06 | -3.305E-08 | +6.874E-08 | 0.0010 |
| | Y = | 0.8687 | -3.305E-08 | +1.002E-06 | +7.181E-08 | 0.0010 |
| | Z = | 0.0085 | +6.874E-08 | +7.181E-08 | +1.205E-06 | 0.0011 |
| lfc4 | X = | 0.0646 | +1.144E-06 | -1.906E-08 | +1.163E-07 | 0.0011 |
| | Y = | 0.8699 | -1.906E-08 | +1.056E-06 | +5.492E-08 | 0.0010 |
| | Z = | 0.0088 | +1.163E-07 | +5.492E-08 | +1.261E-06 | 0.0011 |
| lfc5 | X = | 0.0662 | +1.159E-06 | +5.931E-09 | +1.777E-07 | 0.0011 |
| | Y = | 0.8170 | +5.931E-09 | +9.900E-07 | +9.966E-08 | 0.0010 |
| | Z = | -0.0394 | +1.777E-07 | +9.966E-08 | +1.205E-06 | 0.0011 |
| lfc6 | X = | 0.0156 | +1.060E-06 | -1.282E-07 | +1.681E-08 | 0.0010 |
| | Y = | 0.8152 | -1.282E-07 | +1.310E-06 | +1.468E-07 | 0.0011 |
| | Z = | -0.0391 | +1.681E-08 | +1.468E-07 | +1.219E-06 | 0.0011 |
| lfc8 | X = | 0.0648 | +1.120E-06 | -2.761E-08 | +7.216E-08 | 0.0011 |
| | Y = | 0.8673 | -2.761E-08 | +1.225E-06 | +2.379E-07 | 0.0011 |
| | Z = | -0.0411 | +7.216E-08 | +2.379E-07 | +1.356E-06 | 0.0012 |

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azimuth - elevation - swing

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T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | Covariance Matrix | | | Std Dev (m) |
|-------|-------------------|---------|-------------------|------------|------------|-------------|
| rtc1 | X = | 0.0252 | +1.185E-07 | +2.364E-09 | +1.289E-08 | 0.0003 |
| | *0* Y = | -0.0249 | +2.364E-09 | +1.258E-07 | -1.547E-08 | 0.0004 |
| | Z = | -0.0250 | +1.289E-08 | -1.547E-08 | +1.123E-07 | 0.0003 |
| rtc2 | X = | -0.0247 | +1.204E-07 | -1.159E-08 | +9.750E-09 | 0.0003 |
| | *0* Y = | -0.0250 | -1.159E-08 | +1.464E-07 | -2.257E-08 | 0.0004 |
| | Z = | -0.0261 | +9.750E-09 | -2.257E-08 | +1.243E-07 | 0.0004 |
| rtc3 | X = | -0.0252 | +1.269E-07 | +1.950E-08 | +1.351E-09 | 0.0004 |
| | *0* Y = | 0.0251 | +1.950E-08 | +1.742E-07 | -1.537E-09 | 0.0004 |
| | Z = | -0.0255 | +1.351E-09 | -1.537E-09 | +1.269E-07 | 0.0004 |
| rtc4 | X = | 0.0253 | +1.318E-07 | -4.612E-09 | +1.911E-08 | 0.0004 |
| | *0* Y = | 0.0250 | -4.612E-09 | +1.357E-07 | +1.511E-09 | 0.0004 |
| | Z = | -0.0253 | +1.911E-08 | +1.511E-09 | +1.163E-07 | 0.0003 |
| rtc6 | X = | -0.0246 | +1.454E-07 | -7.271E-09 | +5.408E-09 | 0.0004 |
| | *0* Y = | -0.0254 | -7.271E-09 | +1.950E-07 | -4.951E-08 | 0.0004 |
| | Z = | -0.0767 | +5.408E-09 | -4.951E-08 | +1.741E-07 | 0.0004 |
| rtc7 | X = | -0.0246 | +1.795E-07 | +1.749E-08 | -1.396E-08 | 0.0004 |
| | *0* Y = | 0.0256 | +1.749E-08 | +2.335E-07 | -4.602E-08 | 0.0005 |
| | Z = | -0.0756 | -1.396E-08 | -4.602E-08 | +2.085E-07 | 0.0005 |

Anthropometry and Initial Conditions Photogrammetric Program

| | | | | | | | |
|------|-----|-----|---------|------------|------------|------------|--------|
| rtc8 | *0* | X = | 0.0254 | +2.063E-07 | -2.994E-08 | +2.360E-08 | 0.0005 |
| | | Y = | 0.0252 | -2.994E-08 | +2.257E-07 | -3.314E-08 | 0.0005 |
| | | Z = | -0.0765 | +2.360E-08 | -3.314E-08 | +2.116E-07 | 0.0005 |
| x+06 | *0* | X = | 0.1513 | +1.271E-07 | -5.154E-09 | +1.909E-08 | 0.0004 |
| | | Y = | 0.0000 | -5.154E-09 | +1.306E-07 | -3.167E-10 | 0.0004 |
| | | Z = | 0.0008 | +1.909E-08 | -3.167E-10 | +1.126E-07 | 0.0003 |
| x+12 | *0* | X = | 0.3033 | +1.137E-07 | +8.661E-10 | +9.999E-09 | 0.0003 |
| | | Y = | -0.0005 | +8.661E-10 | +1.262E-07 | -7.340E-09 | 0.0004 |
| | | Z = | 0.0009 | +9.999E-09 | -7.340E-09 | +1.101E-07 | 0.0003 |
| x+18 | *0* | X = | 0.4566 | +1.351E-07 | +3.873E-10 | +9.812E-09 | 0.0004 |
| | | Y = | -0.0005 | +3.873E-10 | +1.464E-07 | -7.028E-09 | 0.0004 |
| | | Z = | 0.0003 | +9.812E-09 | -7.028E-09 | +1.365E-07 | 0.0004 |
| x+24 | *0* | X = | 0.6075 | +1.788E-07 | -4.605E-09 | +1.159E-08 | 0.0004 |
| | | Y = | 0.0000 | -4.605E-09 | +1.882E-07 | -5.868E-09 | 0.0004 |
| | | Z = | -0.0017 | +1.159E-08 | -5.868E-09 | +1.825E-07 | 0.0004 |
| y+06 | *0* | X = | -0.0003 | +1.172E-07 | +6.907E-10 | +8.754E-09 | 0.0003 |
| | | Y = | 0.1520 | +6.907E-10 | +1.351E-07 | -5.050E-09 | 0.0004 |
| | | Z = | 0.0002 | +8.754E-09 | -5.050E-09 | +1.132E-07 | 0.0003 |
| y+12 | *0* | X = | -0.0001 | +1.517E-07 | +1.086E-09 | +6.269E-09 | 0.0004 |
| | | Y = | 0.3043 | +1.086E-09 | +1.610E-07 | -6.024E-10 | 0.0004 |
| | | Z = | 0.0008 | +6.269E-09 | -6.024E-10 | +1.571E-07 | 0.0004 |

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azimuth - elevation - swing

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T R I A N G U L A T E D O B J E C T P O I N T S

| Ident | Position (meters) | | Covariance Matrix | | Std Dev (m) | |
|-------|-------------------|-------------|-------------------|------------|--|----------------------------|
| y-06 | *0* | X = 0.0004 | Y = -0.1518 | Z = 0.0002 | +1.245E-07 -5.917E-10 +4.709E-09 -5.917E-10 +1.532E-07 -1.987E-08 +4.709E-09 -1.987E-08 +1.351E-07 | 0.0004 0.0004 0.0004 |
| y-12 | *0* | X = 0.0007 | Y = -0.3052 | Z = 0.0000 | +1.926E-07 +1.749E-08 +9.474E-09 +1.749E-08 +2.329E-07 +1.667E-08 +9.474E-09 +1.667E-08 +1.929E-07 | 0.0004 0.0005 0.0004 |
| z+06 | *0* | X = -0.0007 | Y = 0.0004 | Z = 0.1513 | +1.086E-07 +9.350E-10 +8.399E-09 +9.350E-10 +1.323E-07 -7.803E-09 +8.399E-09 -7.803E-09 +9.708E-08 | 0.0003 0.0004 0.0003 |
| z+12 | *0* | X = -0.0007 | Y = 0.0006 | Z = 0.3039 | +1.390E-07 +1.416E-09 +5.661E-09 +1.416E-09 +1.869E-07 -1.030E-08 +5.661E-09 -1.030E-08 +1.253E-07 | 0.0004 0.0004 0.0004 |

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

| | | |
|------------|-----|---------------|
| Count = 22 | X = | 0.0010 meters |
| Count = 22 | Y = | 0.0020 meters |

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Count = 22 Z = 0.0013 meters

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azimuth - elevation - swing

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| C O R R E C T I O N S | | A P P L I E D | T O | O B J E C T | C O N T R O L | |
|-----------------------|-----|---------------|-----|-------------|---------------|-----------|
| rtc1 | X = | -0.0002 m | | X = | -0.0002 m | |
| | Y = | 0.0005 m | | sp1 | Y = | 0.0002 m |
| | Z = | 0.0004 m | | | Z = | 0.0005 m |
| x+12 | X = | -0.0015 m | | X = | -0.0001 m | |
| | Y = | -0.0005 m | | y+12 | Y = | -0.0005 m |
| | Z = | 0.0009 m | | | Z = | 0.0008 m |
| z+12 | X = | -0.0007 m | | X = | 0.0007 m | |
| | Y = | 0.0006 m | | y-12 | Y = | -0.0004 m |
| | Z = | -0.0009 m | | | Z = | 0.0000 m |
| rtc2 | X = | 0.0007 m | | X = | -0.0002 m | |
| | Y = | 0.0004 m | | sp2 | Y = | 0.0004 m |
| | Z = | -0.0007 m | | | Z = | 0.0002 m |
| rtc3 | X = | 0.0002 m | | X = | -0.0001 m | |
| | Y = | -0.0003 m | | sp3 | Y = | 0.0000 m |
| | Z = | -0.0001 m | | | Z = | 0.0001 m |
| x+24 | X = | 0.0027 m | | X = | -0.0001 m | |
| | Y = | 0.0000 m | | rtc4 | Y = | -0.0004 m |
| | Z = | -0.0017 m | | | Z = | 0.0001 m |
| sp4 | X = | -0.0005 m | | X = | -0.0011 m | |
| | Y = | -0.0001 m | | x+06 | Y = | 0.0000 m |
| | Z = | 0.0002 m | | | Z = | 0.0008 m |
| y+06 | X = | -0.0003 m | | X = | -0.0007 m | |
| | Y = | -0.0004 m | | z+06 | Y = | 0.0004 m |
| | Z = | 0.0002 m | | | Z = | -0.0011 m |
| y-06 | X = | 0.0004 m | | X = | 0.0008 m | |
| | Y = | 0.0006 m | | rtc6 | Y = | 0.0000 m |
| | Z = | 0.0002 m | | | Z = | -0.0005 m |
| rtc7 | X = | 0.0008 m | | X = | -0.0006 m | |
| | Y = | 0.0002 m | | x+18 | Y = | -0.0005 m |
| | Z = | 0.0006 m | | | Z = | 0.0003 m |
| rtc8 | X = | 0.0000 m | | | | |
| | Y = | -0.0002 m | | | | |
| | Z = | -0.0003 m | | | | |

| | | | |
|-------------------------------|----|-------|---------------|
| X Number of Components = | 21 | RMS = | 0.0008 meters |
| Y Number of Components = | 21 | RMS = | 0.0004 meters |
| Z Number of Components = | 21 | RMS = | 0.0006 meters |

Appendix C Program Listings

XPREP Program Listing

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
PROGRAM XPREP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1      PROGRAM XPREP
2      WRITE (*,*) ' Enter 1 for HEAD digitization '
3      WRITE (*,*) ' Enter 2 for BODY digitization '
4      READ (*,*) I
5      IF(I.EQ.1)CALL HEAD
6      IF(I.EQ.2)CALL BODY
7      END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
8
9      SUBROUTINE HEAD
10     IMPLICIT DOUBLE PRECISION (A-H,O-Z)
11     CHARACTER DATA*17, fn1*12, fn2*12, fn3*12, fn4*12
12     CHARACTER*8 IFRAM(6), IDCAL(2,19), IDHED(19), IDPT, DAY
13     CHARACTER JTITLE*42
14     COMMON /TITLEP/ JTITLE, I    Page
15     INTEGER     IDFD(10), IBUTT, IFID, IRED, IX, IY
16     REAL*8      XY(2,21,3), CALFID(2,10,2)
17     logical     iflag
18     EXTERNAL    SYSTEM
19     INTRINSIC   CHAR, DFLOAT, DSIN, DCOS, DSQRT
20     COMMON      CALCOR(2,50), OBSCOR(2,50), EQN(8,9), DEL(8), ICH3, NFID
21     DATA IFRAM // 'A/Pprism', 'LATprism',
22           'A/Phrv90', 'LATPhrv90', 'A/Phrv45', 'LATPhrv45' /
23     DATA IDCAL // 'c3', 'c5', '2*c13', 'c4', 'c8', '2*c11', '2*c10', '2*c9',
24           'c2', 'c6', '2*c12', 'c1', 'c7', '2*c1', '2*c2', '2*c3',
25           '2*c4', '2*c5', '2*c6', '2*c7', '2*c8', '2*c9', '2*c10' /
26     DATA IDHED // 'lam', 'ram', 'lon', 'ron', 'ltp', 'rtp', 'ctp', 'chin',
27           'ltuskF', 'ltuskM', 'ltuskR', 'rtuskF', 'rtuskM', 'rtuskR',
28           'capLfF', 'capLfR', 'capRtF', 'capRtR', 'capCEN' /
29     DATA CALFID/-147.150, 190.190, -160.380, 77.030, -158.830, -77.220,
30           -146.442, -192.510, 5.760, 190.060, 5.990, -191.570,
31           157.980, 190.490, 146.070, 75.380, 147.920, -77.730,
32           158.540, -191.520, -148.160, 193.950, -162.380, 80.380,
33           -164.310, -75.670, -148.961, -191.214, 5.010, 193.920,
34           4.800, -192.310, 159.210, 193.010, 147.600, 80.050,
35           144.880, -75.390, 158.520, -192.720 /
36 C .....
37 C      ALTEK DIGITIZER 4-BUTTON KEY CONTROL MEANINGS:
38 C      #2:RED=ERROR-BACKUP
39 C      #4:BLUE=???          #1:YELLOW=MISSING
40 C      #3:GREEN=FIDUCIAL or DATA POINT
41 C .....
42     NHED=19
```

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```

43      I  Page=0
44      WRITE (*,*) ' Enter COMM Port number: '
45      READ (*,*) ICOMM
46      ICOMM=ICMM+48
47      CALL SYSTEM ('MODE COM'//CHAR(ICMM)//':9600,0,7,2')
48      OPEN (11,FILE ='COM'//CHAR(ICMM),  ACCESS='TRANSPARENT')
49  C
50      WRITE (*,*) ' Enter HRV number: '
51      READ (*,*) IHRV
52      WRITE (*,*) '
53      WRITE (FN1, '(I4.4,''HEAD.OUT'')')IHRV
54      WRITE (FN2, '(I4.4,''head.132'')')IHRV
55      WRITE (FN3, '(I4.4, ''hing.dat'')')IHRV
56      WRITE (FN4, '(I4.4, ''head.in'')')IHRV

```

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 SUBROUTINE HEAD Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

57      OPEN ( 8,FILE =FN2)
58      OPEN ( 9,FILE =FN3)
59      OPEN (10,FILE =FN1)
60      OPEN (12,FILE =FN4)
61      CALL DATE (DAY)
62      WRITE (JTITLE,
63      .'('' HRV # '',15.5,''      Date: '',A8,''      HEAD   '')') IHRV, DAY
64  C Read order of transformation
65      WRITE (*,*) ' Enter number of parameters for shrinkage fit: '
66      READ (*,*) IOPT1
67      WRITE (*,*) '
68      units=25.4d-3
69      SDX = .75
70      SDY = .75
71      IF (IOPT1.GT.6)IOPT1=8
72      ICH3S=0
73      IF (IOPT1.LE.3) THEN
74          ICH3S=1
75          IOPT1=3
76      END IF
77  C      IOPT3=0
78  C      NRED indicates the number of replications of plate coordinates
79      NRED=1
80  C
81  1      WRITE (*,*) ' Enter 0 when finished'
82      WRITE (*,*) ' Enter 1 if: A/P / CALIBRATION PRISM'
83      WRITE (*,*) ' Enter 2 if: LAT / CALIBRATION PRISM'
84      WRITE (*,*) ' Enter 3 if: A/P / HRV / 90 deg'
85      WRITE (*,*) ' Enter 4 if: LAT / HRV / 90 deg'
86      WRITE (*,*) ' Enter 5 if: A/P / HRV / 45 deg'
87      WRITE (*,*) ' Enter 6 if: LAT / HRV / 45 deg'
88      WRITE (*,*) '
89      READ (*,*) IANS
90      if(ians.eq.0) go to 999
91  C
92  C      Input data for the Preprocessing Program:
93  C      3, 4, 5, 6, 8 in col. 1 Three(etc)-parameter transformation
94  C
95  C      Calibrated Fiducial Coordinates in  FORMAT (2X,I4,4X,2F10.4)
96  C
97  C      Radial Lens Distortion Function:
98  C          Coefficients FK0, FK1          FORMAT (2D20.10)
99  C          Coefficients FK2, FK3          FORMAT (2D20.10)
100 C

```

Anthropometry and Initial Conditions Photogrammetric Program

```
101      CALL CLEAR
102  C
103      FOCAL= -889.D0
104      IF (MOD(IANS,2).EQ.1) FOCAL= -1820.D0
105      CALL NEWPAG
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
106      WRITE (8,1400) IFRAM(IANS)
107      WRITE (10,2400) IFRAM(IANS)
108      write (12, '(i1, 9x, 3f10.3)') iopt1, focal, sdx, sdy
109  C
110  C  Write Calibrated Fiducial Coordinates
111  C
112      JFID=2-MOD(IANS,2)
113      do 8 ifid=1, 10
114      WRITE (8,1420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
115      WRITE (10,2420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
116      8      WRITE (12,1410) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
117      write (12, '(/ //// /)')*
118  C
119  C  Read & Write Frame ID
120  C
121      WRITE (9,1516) IFRAM(IANS), FOCAL, SDX, SDY
122      WRITE (12,'(A8)') IFRAM(IANS)
123      CALL NEWPAG
124      WRITE (8,1380) IFRAM(IANS)
125      WRITE (10,2380) IFRAM(IANS)
126      NRED=1
127  ****
128  C  Start major loop for digitizing x-rays:
129      iflag=.true.
130      DO 40 IRED=1,NRED
131      IFID=1
132      10      READ (11) DATA
133      WRITE (*,*) CHAR(7)
134  C
135  C  DECODE data from CHARACTER to INTEGER
136  C
137      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
138      READ (DATA, 20) IBUTT,IX,IY
139      20      FORMAT (I1,1X,I6,1X,I6)
140  C
141  C  Interpret action to take based on which button was pressed:
142      IF (IBUTT .EQ. 3) THEN
143          XY(1,IFID,IRED)=IX*units
144          XY(2,IFID,IRED)=IY*units
145          WRITE (*,30) 'FIDUCIAL',IFID,XY(1,IFID,IRED),XY(2,IFID,IRED)
146      30      FORMAT (' ',A,1X,I3,2X,F8.4,2X,F8.4)
147          if(iflag)then
148              isavex=ix
149              isavey=iy
150              iflag=.false.
151          endif
152          IFID=IFID+1
153      ELSEIF (IBUTT .EQ. 2) THEN
154          IFID=IFID-1
```

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SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
155      WRITE (*,*) 'Backing up one to FIDUCIAL # ',IFID
156      WRITE (*,*) CHAR(7),CHAR(7)
157      ELSEIF (IBUTT .EQ. 1) THEN
158          XY(1,IFID,IRED)=-1.
159          XY(2,IFID,IRED)=-1.
160          WRITE (*,*) 'MISSING ', IFID
161          IFID=IFID+1
162      ELSE
163          WRITE (*,*) 'Not an option. Redo'
164      ENDIF
165      IF (IFID .LE. 10) GO TO 10
166      40  CONTINUE
167      C
168      C Write out the raw data to raw.dat
169      DO 60 IFID=1,10
170      IF (XY(1,IFID,1).GT.0) WRITE (12,50) IFID,( XY(1,IFID,IRED),
171          XY(2,IFID,IRED),IRED=1,NRED)
172      50  FORMAT (6X,I4,S,6F10.3)
173      60  CONTINUE
174      WRITE (12,*)
175      C
176      IFID=0
177      DO 200 K=1,10
178      C
179      C Read measured fiducial coordinates
180      C
181      IFID=IFID+1
182      80  IF (IFID.GT.10) GO TO 210
183      IF (XY(1,IFID,1).LE.0) then
184          IFID=IFID+1
185          GO TO 80
186      ENDIF
187      KK=IFID
188      XMAX=0.0D0
189      YMAX=0.0D0
190      XMIN=1000.0D0
191      YMIN=1000.0D0
192      SUMX=0.0D0
193      SUMY=0.0D0
194      DO 100 J=1,NRED
195          X=XY(1,IFID,J)
196          Y=XY(2,IFID,J)
197          IF (X.EQ.0.AND.Y.EQ.0) GO TO 110
198          SUMX=SUMX+X
199          SUMY=SUMY+Y
200          IF (NRED.EQ.1) GO TO 100
201          IF (XMAX.LT.X) XMAX=X
202          IF (XMIN.GT.X) XMIN=X
203          IF (YMAX.LT.Y) YMAX=Y
```

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SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
204      IF (YMIN.GT.Y) YMIN=Y
205      100  CONTINUE
206      IF (NRED.NE.1) GO TO 120
207      110  XMIN=0.0D0
```

Anthropometry and Initial Conditions Photogrammetric Program

```
208      YMIN=0.0D0
209  120      J=NRED
210      IF (J.EQ.0) J=1
211      XT=SUMX/J
212      YT=SUMY/J
213  C  Store averaged digitized coordinates
214      OBSCOR(1,K)=XT
215      OBSCOR(2,K)=YT
216      CALCOR(1,K)=CALFID(1,KK,JFID)
217      CALCOR(2,K)=CALFID(2,KK,JFID)
218      IDFD(K)=KK
219      WRITE ( 8,1540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
220      WRITE (10,2540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
221  200  CONTINUE
222  C
223  C  Compute the 3-Parameter Check Transformation.
224  C
225  210  NFID=K-1
226      ICH3S=1
227      CALL FOURP
228      WRITE (*,*)' 3-Parameter Check Transformation'
229      rmsx=0.
230      rmsy=0.
231      DO 220 I=1,NFID
232          X=OBSCOR(1,I)
233          Y=OBSCOR(2,I)
234          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
235          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
236          KK=IDFD(I)
237          WRITE (*,2560) KK,XT,YT
238          rmsx=rmsx+xt*xt
239          rmsy=rmsy+yt*yt
240  220  CONTINUE
241      rmsx3=dsqrt(rmsx/nfid)
242      rmsy3=dsqrt(rmsy/nfid)
243      write (*,230)rmsx, rmsy
244  230  format (' rms= ',2f7.3)
245      WRITE (*,*)'
246      WRITE (*,*)IOPT1,'-Parameter Transformation'
247      rmsx=0.
248      rmsy=0.
249  C
250  C  Compute the Multi-Parameter Transformation.
251      ICH3=ICH3S
252      IF (IOPT1.LE.5) CALL FOURP
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
253      IF (IOPT1.EQ.5) CALL FIVEP
254      IF (IOPT1.EQ.6) CALL SIXP
255      IF (IOPT1.EQ.8) CALL EIGHTP
256      WRITE ( 8,1550) IOPT1
257      WRITE (10,2550) IOPT1
258  C
259  C  Compute Residuals For the Fiducial Coordinates
260  C
261      DO 240 I=1,NFID
262          X=OBSCOR(1,I)
263          Y=OBSCOR(2,I)
264          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
265          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
```

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```

266      KK=IDFD(I)
267      WRITE ( 8,1560) KK,XT,YT
268      WRITE (10,2560) KK,XT,YT
269      WRITE ( *,2560) KK,XT,YT
270      rmsx=rmsx+xt*xt
271      rmsy=rmsy+yt*yt
272 240 CONTINUE
273      rmsx=dsqrt(rmsx/nfid)
274      rmsy=dsqrt(rmsy/nfid)
275      write (*,230)rmsx, rmsy
276      write( 8, 1545)rmsx, rmsy, rmsx3, rmsy3, del
277      write(10, 2545)rmsx, rmsy, rmsx3, rmsy3, del
278 1545 FORMAT(43X,'RMS',2F15.3/43X,'RMS(CHECK)',F8.3, F15.3/
279      .           /45X,'TRANSFORMATION PARAMETERS ARE:'//33X,2F11.6,F11.4,
280      .           2F11.6/33X,2F11.6,F11.4//)
281 2545 FORMAT(/23X,'Rms',2F15.3/23X,'Rms(check)',F8.3, F15.3/
282      .           /25X,'Transformation Parameters Are:'//13X,2F11.6,F11.4,
283      .           2F11.6/13X,2F11.6,F11.4)
284      CALL NEWPAG
285      IF (NRED .GT. 1) WRITE (8,1570) IFRAM(IANS)
286      IF (NRED .GT. 1) WRITE (10,2570)IFRAM(IANS)
287      IF (NRED .EQ. 1) WRITE (8,1575) IFRAM(IANS)
288      IF (NRED .EQ. 1) WRITE (10,2575)IFRAM(IANS)
289      PAUSE
290  ****
291      IF (IANS.GE.3) GO TO 500
292 C Compute the Averaged Coordinates of the Calibration Prism
293 C
294 C1250 READ ( 7,1580) IDPT,((TEMPPM1(I,J),I=1,2),J=1,NRED)
295      DO 260 IRED=1,NRED
296      ICAL=1
297 250 READ (11) DATA
298      WRITE (*,*) CHAR(7)
299 C
300 C DECODE data from CHARACTER to INTEGER
301 C
302      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)

```

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 SUBROUTINE HEAD Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

303      READ (DATA, 20) IBUTT,IX,IY
304 C
305 C Interpret action to take based on which button was pressed:
306      IF (IBUTT .EQ. 3) THEN
307          XY(1,ICAL,IRED)=IX*units
308          XY(2,ICAL,IRED)=IY*units
309          WRITE (*,30)'CAL. PT.',ICAL,XY(1,ICAL,IRED),XY(2,ICAL,IRED)
310          ICAL=ICAL+1
311      ELSEIF (IBUTT .EQ. 2) THEN
312          ICAL=ICAL-1
313          WRITE (*,*) 'Backing up one to CAL. PT. # ',ICAL
314          WRITE (*,*) CHAR(7),CHAR(7)
315      ELSEIF (IBUTT .EQ. 1) THEN
316          XY(1,ICAL,IRED)=-1.
317          XY(2,ICAL,IRED)=-1.
318          WRITE (*,*) 'MISSING ', ICAL
319          ICAL=ICAL+1
320      ELSE
321          WRITE (*,*) 'Not an option. Redo'
322      ENDIF
323      IF (ICAL .LE. 19) GO TO 250

```

Anthropometry and Initial Conditions Photogrammetric Program

```
324 260 CONTINUE
325 C
326 DO 280 ICAL=1,19
327     IF (XY(1,ICAL,1).GT.0) WRITE (12,270) IDCAL(IANS,ICAL),
328             (XY(1,ICAL,IRED),XY(2,ICAL,IRED),IRED=1,NRED)
329 270     FORMAT (2X,AB,1X,S,6(F9.4,1X))
330 280 CONTINUE
331     WRITE (12,*)
332 C
333     ICAL=0
334     DO 390 K=1,19
335 C
336 C Process measured calibration prism coordinates
337 C
338     ICAL=ICAL+1
339 290     IF (ICAL.GT.19) GO TO 400
340     IF (XY(1,ICAL,1).LE.0) then
341         ICAL=ICAL+1
342         GO TO 290
343     ENDIF
344     KK=ICAL
345     XMAX=0.0D0
346     YMAX=0.0D0
347     XMIN=1000.0D0
348     YMIN=1000.0D0
349     SUMX=0.0D0
350     SUMY=0.0D0
351     DO 300 J=1,NRED
```

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ROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
352     X=XY(1,ICAL,J)
353     Y=XY(2,ICAL,J)
354     IF (X.EQ.0.AND.Y.EQ.0) GO TO 310
355     SUMX=SUMX+X
356     SUMY=SUMY+Y
357     IF (NRD.EQ.1) GO TO 300
358     IF (XMAX.LT.X) XMAX=X
359     IF (XMIN.GT.X) XMIN=X
360     IF (YMAX.LT.Y) YMAX=Y
361     IF (YMIN.GT.Y) YMIN=Y
362 300     CONTINUE
363     IF (NRD.NE.1) GO TO 320
364 310     XMIN=0.0D0
365     YMIN=0.0D0
366 320     J=NRED
367     IF (J.EQ.0) J=1
368     X=SUMX/J
369     Y=SUMY/J
370     XM=XMAX-XMIN
371     YM=YMAX-YMIN
372     IDPT=IDCAL(IANS,KK)
373 C
374 C Correct Measured Coordinates for Film Shrinkage
375 C
376     XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
377     YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
378 C
379     IF (NRD .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
380     IF (NRD .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
381     IF (NRD .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
```

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```
382      IF (NRRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT
383  C
384  C  Write Records for Triangulation Input to File: "img.dat"
385  C
386      WRITE (9,1610) IDPT,XT,YT,IFRAM(IANS)
387  390  CONTINUE
388  C
389  400  write (*,*)' Re-do first fiducial'
390  READ (11) DATA
391  WRITE (*,*) CHAR(7)
392  C
393  C  DECODE data from CHARACTER to INTEGER
394  C
395      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
396  READ (DATA, 20) IBUTT,IX,IY
397  if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
398      write (*,*)' You blew it', ix, iy, ' vs.', isavex, isavey
399      WRITE (*,*) CHAR(7)
400      WRITE (*,*) CHAR(7)
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
401      go to 400
402      endif
403      PAUSE
404      WRITE (9,'(A8)') '*****'
405      GO TO 1
406  ****
407  C
408  C  Compute the Averaged Coordinates of the HRV head
409  C
410  500  DO 560 IRED=1,NRED
411      IHED=1
412  550  READ (11) DATA
413  WRITE (*,*) CHAR(7)
414  C
415  C  DECODE data from CHARACTER to INTEGER
416  C
417      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
418  READ (DATA, 20) IBUTT,IX,IY
419  C
420  C  Interpret action to take based on which button was pressed:
421      IF (IBUTT .EQ. 3) THEN
422          XY(1,IHED,IRED)=IX*units
423          XY(2,IHED,IRED)=IY*units
424          WRITE (*,555)IDHED(IHED),XY(1,IHED,IRED),XY(2,IHED,IRED)
425  555      FORMAT (A10,2X,F8.4,2X,F8.4)
426          IHED=IHED+1
427      ELSEIF (IBUTT .EQ. 2) THEN
428          IHED=IHED-1
429          WRITE (*,*) 'Backing up one to ',IDHED(IHED)
430          WRITE (*,*) CHAR(7),CHAR(7)
431      ELSEIF (IBUTT .EQ. 1) THEN
432          XY(1,IHED,IRED)=-1.
433          XY(2,IHED,IRED)=-1.
434          WRITE (*,*) 'MISSING ', IDHED(IHED)
435          IHED=IHED+1
436      ELSE
437          WRITE (*,*) 'Not an option. Redo'
438      ENDIF
439      IF (IHED .LE. NHED) GO TO 550
```

Anthropometry and Initial Conditions Photogrammetric Program

```
440 560 CONTINUE
441 C
442 DO 580 IHED=1,NHED
443   IF (XY(1,IHED,1).GT.0) WRITE (12,270) IDHED(IHED),
444     (XY(1,IHED,IRED),XY(2,IHED,IRED),IRED=1,NRED)
445 580 CONTINUE
446   WRITE (12,*)
447 C
448   IHED=0
449   DO 690 K=1,NHED
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
450 C
451 C Process measured head coordinates
452 C
453   IHED=IHED+1
454 590   IF (IHED.GT.NHED) GO TO 700
455   IF (XY(1,IHED,1).LE.0) then
456     IHED=IHED+1
457     GO TO 590
458   ENDIF
459   KK=IHED
460   XMAX=0.0D0
461   YMAX=0.0D0
462   XMIN=1000.0D0
463   YMIN=1000.0D0
464   SUMX=0.0D0
465   SUMY=0.0D0
466   DO 600 J=1,NRED
467     X=XY(1,IHED,J)
468     Y=XY(2,IHED,J)
469     IF (X.EQ.0.AND.Y.EQ.0) GO TO 610
470     SUMX=SUMX+X
471     SUMY=SUMY+Y
472     IF (NRED.EQ.1) GO TO 600
473     IF (XMAX.LT.X) XMAX=X
474     IF (XMIN.GT.X) XMIN=X
475     IF (YMAX.LT.Y) YMAX=Y
476     IF (YMIN.GT.Y) YMIN=Y
477   600   CONTINUE
478   IF (NRED.NE.1) GO TO 620
479   610   XMIN=0.0D0
480   YMIN=0.0D0
481   620   J=NRED
482   IF (J.EQ.0) J=1
483   X=SUMX/J
484   Y=SUMY/J
485   XM=XMAX-XMIN
486   YM=YMAX-YMIN
487   IDPT=IDHED(IHED)
488 C
489 C Correct Measured Coordinates for Film Shrinkage
490 C
491   XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
492   YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
493 C
494   IF (NRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
495   IF (NRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
496   IF (NRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
497   IF (NRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT
```

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```
498 C
499 C Write Records for Triangulation Input to file: "img.dat"
```

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
500      WRITE ( 9,1610) IDPT,XT,YT,IFRAM(IANS)
501 690  CONTINUE
502 C
503 700  ican=0
504 710  write (*,*)' Re-do first fiducial'
505  READ (11) DATA
506  WRITE (*,*) CHAR(7)
507 C
508 C DECODE data from CHARACTER to INTEGER
509 C
510  if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
511  READ (DATA, 20) IBUTT,IX,IY
512  if(iabs(ix-isavex)+iabs(iy-isavy) .gt. 3*(rmsx+rmsy)/units)then
513    write (*,*)' You blew it', ix, iy, ' vs.', isavex, isavy
514    WRITE (*,*) CHAR(7)
515    WRITE (*,*) CHAR(7)
516    ican=ican+1
517    if(ican.le.4) go to 710
518    write(*, *)'No more tries...origin lost...going back to menu'
519    WRITE (9,'(A8)') '*****'
520    go to 1
521  endif
522  PAUSE
523  WRITE (9,'(A8)') '*****'
524  go to 1
525 C
526 999  CALL CLEAR
527  WRITE (12,'(A8)') '*****'
528  WRITE ( 8,*)CHAR(12)
529  WRITE (10,*)CHAR(12)
530 C FORMATTED OUTPUT FOR 132-COLUMN PAPER:
531 C
532 1370 FORMAT (211,8X,3F10.3)
533 1380 FORMAT (40X,'FIDUCIAL MEASUREMENTS OF FRAME ',A8// 36X,'ID',
534  . 12X,'AVERAGE',13X,'MAX SPREAD'/48X,'X',9X,'Y',11X,'X',9X,'Y')
535 1400 FORMAT (36X,'CALIBRATED FIDUCIAL COORDINATES OF FRAME ',A8//,
536  . 46X, 'FID', 9X, 'X', 12X, 'Y' )
537 1410 FORMAT (2X,I4,4X,2F10.4)
538 1420 FORMAT (45X,I4,5X,F8.3,5X,F8.3)
539 1440 FORMAT (2D20.10)
540 1445 FORMAT (3D20.10)
541 1450 FORMAT (//42X,SP,'CALIBRATED FOCAL LENGTH = ',F9.3,' mm.')
542 1460 FORMAT (///51X,SP,'LENS DISTORTION'//51X,'RADIAL PARAMETERS'/31X
543  . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/51X'K3='D15.8D2
544  . //:45X,'LENS DECENTRATION PARAMETERS'/31X,'J1='D15.8D2,
545  . ' J2='D15.8D2,' PHI='D15.8D2/)
546 1470 FORMAT (I2)
547 1480 FORMAT (2F10.3)
548 1485 FORMAT (8X,'Calibrated Focal Length (CFL) in millimeters = ')
```

Anthropometry and Initial Conditions Photogrammetric Program

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SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
549 1500 FORMAT (44X,2F13.3)
550 1510 FORMAT (6X,14,6F10.3)
551 1516 FORMAT (A8,2X,SP,F10.3:,SS,2(F10.3),10X)
552 1540 FORMAT (36X,14,2X,2F10.3,2X,2F10.3)
553 1550 FORMAT (//I38,'-PARAMETER RESIDUALS OF THE FIDUCIAL COORDINATES'//
554 . 43X, 'FID', 11X, 'X', 14X, 'Y' )
555 1560 FORMAT (42X,14,2F15.3)
556 1570 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//22X,'ID',11X,
557 . 'MEASURED',13X,'ADJUSTED',13X,'MAX SPREAD',11X,'FRAME'/
558 . 34X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
559 1575 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//38X,'ID',11X,
560 . 'MEASURED',13X,'ADJUSTED'/50X,'X',9X,'Y',10X,'X',9X,'Y')
561 1580 FORMAT (2X,A8,6F10.3)
562 1600 FORMAT (18X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
563 1605 FORMAT (34X,A8,2X,2F10.3,1X,2F10.3)
564 1610 FORMAT (A8,2X,2F10.4,15X,'Photo ',A8)
565 C
566 C FORMATTED OUTPUT FOR 80-COLUMN PAPER:
567 C
568 2380 FORMAT (20X,'Fiducial Measurements of Frame ',A8// 16X,'ID',12X,
569 . 'Average',13X,'Max Spread'/28X,'X',9X,'Y',11X,'X',9X,'Y')
570 2400 FORMAT (16X,'Calibrated Fiducial Coordinates of Frame ',A8// 26X, 'Fid', 9X, 'X', 12X, 'Y')
571 .
572 2420 FORMAT (25X,14,5X,F8.3,5X,F8.3)
573 2450 FORMAT (//25X,SP,'Calibrated Focal Length = ',F9.3,' mm.')
574 2460 FORMAT (///31X,SP,'Lens Distortion'//31X,'Radial Parameters'/11X
575 . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/31X'K3='D15.8D2
576 . ,//:25X,'Lens Decentration Parameters'/11X,'J1= 'D15.8D2,
577 . ' J2= 'D15.8D2,' PHI= 'D15.8D2/')
578 2500 FORMAT (24X,2F13.3)
579 2540 FORMAT (16X,14,2X,2F10.3,2X,2F10.3)
580 2550 FORMAT (//I18,'-Parameter Residuals of the Fiducial Coordinates'//
581 . 23X, 'Fid', 11X, 'X', 14X, 'Y')
582 2560 FORMAT (22X,14,2F15.3)
583 2570 FORMAT (//22X,'Plate Coordinates for Frame ',A8// 11X,
584 . 'Measured',13X,'Adjusted',13X,'Max Spread',11X,'Frame'/
585 . 17X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
586 2575 FORMAT (//22X,'Plate Coordinates for Frame ',A8//18X,'ID',11X,
587 . 'Measured',13X,'Adjusted'/30X,'X',9X,'Y',10X,'X',9X,'Y')
588 2600 FORMAT (X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
589 2605 FORMAT (14X,A8,2X,2F10.3,1X,2F10.3)
590 C
591 CALL BEEP
592 CLOSE (8)
593 CLOSE (9)
594 CLOSE (10)
595 END
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
596
597      SUBROUTINE BODY
598      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
599      CHARACTER DATA*17, fn1*12, fn2*12, fn3*12, fn4*12
600      CHARACTER*8 IFRAM4), IDBOD(16), IDPT, DAY
601      CHARACTER JTITLE*42
```

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```

602      COMMON /TITLEP/ JTITLE, I    Page
603      INTEGER     IDFD(10), IBUTT, IFID, IRED, IX, IY
604      REAL*8      XY(2,21,3), CALFID(2,10,2)
605      logical     iflag
606      EXTERNAL    SYSTEM
607      INTRINSIC   CHAR,DFLOAT, DSIN, DCOS, DSQRT
608      COMMON       CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
609      DATA IFRAM //LfEyLfSh', 'RtEyLfSh', 'LfEyRtSh', 'RtEyRtSh'/
610      DATA IDBOD //Origin', 'Rib_Lf', 'Rib_Rt', 'SpineTop', 'SpineBot',
611      .           'spine_bb', 'sternum',   'lf_shold', 'rt_shold',
612      .           'ltp', 'rtp', 'ctp', 'lneckT', 'lneckB', 'rneckT', 'rneckB'/
613      DATA CALFID/-190.190, -147.150, -77.030, -160.380, 77.220, -158.830,
614      .           192.510, -146.442, -190.060, 5.760, 191.570, 5.990,
615      .           -190.490, 157.980, -75.380, 146.070, 77.730, 147.920,
616      .           191.520, 158.540, -193.950, -148.160, -80.380, -162.380,
617      .           75.670, -164.310, 191.214, -148.961, -193.920, 5.010,
618      .           192.310, 4.800, -193.010, 159.210, -80.050, 147.600,
619      .           75.390, 144.880, 192.720, 158.520/
620  C .....
621  C      ALTEK DIGITIZER 4-BUTTON KEY CONTROL MEANINGS:
622  C      #2:RED=ERROR-BACKUP
623  C      #4:BLUE=???      #1:YELLOW=MISSING
624  C      #3:GREEN=FIDUCIAL or DATA POINT
625  C .....
626      NBOD=16
627      I    Page=0
628      WRITE (*,*) ' Enter COMM Port number: '
629      READ (*,*) Icmm
630      icmm=icmm+48
631      CALL SYSTEM ('MODE COM'//char(icmm)//':9600,0,7,2')
632      OPEN (11,FILE ='COM'//char(icmm), ACCESS='TRANSPARENT')
633  C
634      WRITE (*,*) ' Enter HRV number: '
635      READ (*,*) IHRV
636      WRITE (*,*) 
637      WRITE (FN1, '(I4.4,''BODY.OUT'')')IHRV
638      WRITE (FN2, '(I4.4,''body.132'')')IHRV
639      WRITE (FN3, '(I4.4,''bimg.dat'')')IHRV
640      WRITE (FN4, '(I4.4,''body.in'')')IHRV
641      OPEN ( 8,FILE =FN2)
642      OPEN ( 9,FILE =FN3)
643      OPEN (10,FILE =FN1)
644      OPEN (12,FILE =FN4)

```

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 SUBROUTINE BODY Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

645      CALL DATE (DAY)
646      WRITE (JTITLE,
647      .('' HRV # '',15.5,''      Date: '',A8,''      BODY(T-1)'')) IHRV, DAY
648  C Read order of transformation
649      WRITE (*,*) ' Enter number of parameters for shrinkage fit: '
650      READ (*,*) IOPT1
651      WRITE (*,*) 
652      units=25.4d-3
653      SDX = 1.0
654      SDY = 1.0
655      IF (IOPT1.GT.6)IOPT1=8
656      ICH3S=0
657      IF (IOPT1.LE.3) THEN
658          ICH3S=1
659          IOPT1=3

```

Anthropometry and Initial Conditions Photogrammetric Program

```
660      END IF
661 C      IOPT3=0
662 C  NRED indicates the number of replications of plate coordinates
663 C      NRED=1
664 C
665 1      WRITE (*,*) ' Enter 0 when finished'
666      WRITE (*,*) ' Enter 1 if: Left Eye View--Left Shoulder to Plate'
667      WRITE (*,*) ' Enter 2 if: Right Eye View--Left Shoulder to Plate'
668      WRITE (*,*) ' Enter 3 if: Left Eye View--Right Shoulder to Plate'
669      WRITE (*,*) ' Enter 4 if: Right Eye View--Right Shoulder to Plate'
670      WRITE (*,*)
671      READ (*,*) IANS
672      if(ians.eq.0) go to 999
673 C
674 C  Input data for the Preprocessing Program:
675 C      3, 4, 5, 6, 8 in col. 1 Three(etc)-parameter transformation
676 C
677 C  Calibrated Fiducial Coordinates in  FORMAT (2X,I4,4X,2F10.4)
678 C
679 C  Radial Lens Distortion Function:
680 C      Coefficients FK0, FK1           FORMAT (2D20.10)
681 C      Coefficients FK2, FK3           FORMAT (2D20.10)
682 C
683      CALL CLEAR
684 C
685      FOCAL= -889.000
686      CALL NEWPAG
687      WRITE (8,1400) IFRAM(IANS)
688      WRITE (10,2400) IFRAM(IANS)
689      write (12, '(i1, 9x, 3f10.3)') iopt1, focal, sdx, sdy
690 C
691 C  Write Calibrated Fiducial Coordinates
692 C
693      JFID=2
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
694      do 8 ifid=1, 10
695      WRITE ( 8,1420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
696      WRITE (10,2420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
697 8      WRITE (12,1410) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
698      write (12, '////')
699 C
700 C  Read & Write Frame ID
701 C
702      WRITE ( 9,1516) IFRAM(IANS), FOCAL, SDX, SDY
703      WRITE (12,'(A8)') IFRAM(IANS)
704      CALL NEWPAG
705      WRITE ( 8,1380) IFRAM(IANS)
706      WRITE (10,2380) IFRAM(IANS)
707      NRED=1
708 C*****
709 C  Start major loop for digitizing x-rays:
710      iflag=.true.
711      DO 40 IRED=1,NRED
712      IFID=1
713 10      READ (11) DATA
714      WRITE (*,*) CHAR(7)
715 C
716 C  DECODE data from CHARACTER to INTEGER
717 C
```

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```

718      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
719      READ (DATA, 20) IBUTT,IX,IY
720  20  FORMAT (I1,1X,I6,1X,I6)
721  C
722  C Interpret action to take based on which button was pressed:
723      IF (IBUTT .EQ. 3) THEN
724          XY(1,IFID,IRED)=IX*units
725          XY(2,IFID,IRED)=IY*units
726          WRITE (*,30) 'FIDUCIAL',IFID,XY(1,IFID,IRED),XY(2,IFID,IRED)
727  30  FORMAT (' ',A,1X,I3,2X,F8.4,2X,F8.4)
728      if(iflag)then
729          isavex=ix
730          isavey=iy
731          iflag=.false.
732      endif
733      IFID=IFID+1
734      ELSEIF (IBUTT .EQ. 2) THEN
735          IFID=IFID-1
736          WRITE (*,*) 'Backing up one to FIDUCIAL # ',IFID
737          WRITE (*,*) CHAR(7),CHAR(7)
738      ELSEIF (IBUTT .EQ. 1) THEN
739          XY(1,IFID,IRED)=-1.
740          XY(2,IFID,IRED)=-1.
741          WRITE (*,*) 'MISSING ', IFID
742          IFID=IFID+1

```

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 SUBROUTINE BODY Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

743      ELSE
744          WRITE (*,*) 'Not an option. Redo'
745      ENDIF
746      IF (IFID .LE. 10) GO TO 10
747  40  CONTINUE
748  C
749  C Write out the raw data to raw.dat
750      DO 60 IFID=1,10
751          IF (XY(1,IFID,1).GT.0) WRITE (12,50) IFID,( XY(1,IFID,IRED),
752                                         XY(2,IFID,IRED),IRED=1,NRED)
753  50  FORMAT (6X,14,S,6F10.3)
754  60  CONTINUE
755          WRITE (12,*)
756  C
757          IFID=0
758          DO 200 K=1,10
759  C
760  C Read measured fiducial coordinates
761  C
762          IFID=IFID+1
763  80  IF (IFID.GT.10) GO TO 210
764          IF (XY(1,IFID,1).LE.0) then
765              IFID=IFID+1
766              GO TO 80
767          ENDIF
768          KK=IFID
769          XMAX=0.0D0
770          YMAX=0.0D0
771          XMIN=1000.0D0
772          YMIN=1000.0D0
773          SUMX=0.0D0
774          SUMY=0.0D0
775          DO 100 J=1,NRED

```

Anthropometry and Initial Conditions Photogrammetric Program

```
776      X=XY(1,IFID,J)
777      Y=XY(2,IFID,J)
778      IF (X.EQ.0.AND.Y.EQ.0) GO TO 110
779      SUMX=SUMX+X
780      SUMY=SUMY+Y
781      IF (NRED.EQ.1) GO TO 100
782      IF (XMAX.LT.X) XMAX=X
783      IF (XMIN.GT.X) XMIN=X
784      IF (YMAX.LT.Y) YMAX=Y
785      IF (YMIN.GT.Y) YMIN=Y
786 100      CONTINUE
787      IF (NRED.NE.1) GO TO 120
788 110      XMIN=0.0D0
789      YMIN=0.0D0
790 120      J=NRED
791      IF (J.EQ.0) J=1
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
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```
792      XT=SUMX/J
793      YT=SUMY/J
794 C  Store averaged digitized coordinates
795      OBSCOR(1,K)=XT
796      OBSCOR(2,K)=YT
797      CALCOR(1,K)=CALFID(1,KK,JFID)
798      CALCOR(2,K)=CALFID(2,KK,JFID)
799      IDFD(K)=KK
800      WRITE ( 8,1540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
801      WRITE (10,2540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
802 200  CONTINUE
803 C
804 C  Compute the 3-Parameter Check Transformation.
805 C
806 210  NFID=K-1
807  ICH3S=1
808  CALL FOURP
809  WRITE (*,*)' 3-Parameter Check Transformation'
810  rmsx=0.
811  rmsy=0.
812  DO 220 I=1,NFID
813    X=OBSCOR(1,I)
814    Y=OBSCOR(2,I)
815    XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
816    YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
817    KK=IDFD(I)
818    WRITE ( *,2560) KK,XT,YT
819    rmsx=rmsx+xt*xt
820    rmsy=rmsy+yt*yt
821 220  CONTINUE
822  rmsx3=dsqrt(rmsx/nfid)
823  rmsy3=dsqrt(rmsy/nfid)
824  write (*,230)rmsx, rmsy
825 230  format (' rms= ',2f7.3)
826  WRITE (*,*)'
827  WRITE (*,*)iopt1,'-Parameter Transformation'
828  rmsx=0.
829  rmsy=0.
830 C
831 C  Compute the Multi-Parameter Transformation.
832  ICH3=ICH3S
833  IF (IOPT1.LE.5) CALL FOURP
```

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```
834      IF (IOPT1.EQ.5) CALL FIVEP
835      IF (IOPT1.EQ.6) CALL SIXP
836      IF (IOPT1.EQ.8) CALL EIGHTP
837      WRITE ( 8,1550) IOPT1
838      WRITE (10,2550) IOPT1
839  C
840  C  Compute Residuals For the Fiducial Coordinates
841  C
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
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```
842      DO 240 I=1,NFID
843      X=OBSCOR(1,I)
844      Y=OBSCOR(2,I)
845      XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
846      YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
847      KK=IDFD(I)
848      WRITE ( 8,1560) KK,XT,YT
849      WRITE (10,2560) KK,XT,YT
850      WRITE (*,2560) KK,XT,YT
851      rmsx=rmsx+xt*xt
852      rmsy=rmsy+yt*yt
853 240 CONTINUE
854      rmsx=dsqrt(rmsx/nfid)
855      rmsy=dsqrt(rmsy/nfid)
856      write (*,230) rmsx, rmsy
857      write( 8, 1545) rmsx, rmsy, rmsx3, rmsy3, del
858      write(10, 2545) rmsx, rmsy, rmsx3, rmsy3, del
859      1545 FORMAT(/43X,'RMS',2F15.3/43X,'RMS(CHECK)',F8.3, F15.3/
860      .           /45X,'TRANSFORMATION PARAMETERS ARE:'//33X,2F11.6,F11.4,
861      .           2F11.6/33X,2F11.6,F11.4//)
862      2545 FORMAT(/23X,'Rms',2F15.3/23X,'Rms(check)',F8.3, F15.3/
863      .           /25X,'Transformation Parameters Are:'//13X,2F11.6,F11.4,
864      .           2F11.6/13X,2F11.6,F11.4)
865      CALL NEWPAG
866      IF (NRED .GT. 1) WRITE (8,1570) IFRAM(IANS)
867      IF (NRED .GT. 1) WRITE (10,2570) IFRAM(IANS)
868      IF (NRED .EQ. 1) WRITE (8,1575) IFRAM(IANS)
869      IF (NRED .EQ. 1) WRITE (10,2575) IFRAM(IANS)
870      PAUSE
871  ****
872  C
873  C  Compute the Averaged Coordinates of the HRV body
874  C
875  500 DO 560 IRED=1,NRED
876      IBOD=1
877  550 READ (11) DATA
878      WRITE (*,*) CHAR(7)
879  C
880  C  DECODE data from CHARACTER to INTEGER
881  C
882      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
883      READ (DATA, 20) IBUTT,IX,IY
884  C
885  C  Interpret action to take based on which button was pressed:
886      IF (IBUTT .EQ. 3) THEN
887          XY(1,IBOD,IRED)=IX*units
888          XY(2,IBOD,IRED)=IY*units
889          WRITE (*,555) IDBOD(IBOD),XY(1,IBOD,IRED),XY(2,IBOD,IRED)
890  555      FORMAT (A10,2X,F8.4,2X,F8.4)
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
891           IBOD=IBOD+1
892           ELSEIF (IBUTT .EQ. 2) THEN
893               IBOD=IBOD-1
894               WRITE (*,*) 'Backing up one to ', IDBOD(IBOD)
895               WRITE (*,*) CHAR(7),CHAR(7)
896           ELSEIF (IBUTT .EQ. 1) THEN
897               XY(1,IBOD,IRED)=-1.
898               XY(2,IBOD,IRED)=-1.
899               WRITE (*,*) 'MISSING ', IDBOD(IBOD)
900               IBOD=IBOD+1
901           ELSE
902               WRITE (*,*) 'Not an option. Redo'
903           ENDIF
904           IF (IBOD .LE. NBOD) GO TO 550
905 560 CONTINUE
906 C
907 DO 580 IBOD=1,NBOD
908     IF (XY(1,IBOD,1).GT.0) WRITE (12,270) IDBOD(IBOD),
909     (XY(1,IBOD,IRED),XY(2,IBOD,IRED),IRED=1,NRED)
910 270     FORMAT (2X,A8,1X,S,6(F9.4,1X))
911 580 CONTINUE
912     WRITE (12,*)
913 C
914     IBOD=0
915     DO 690 K=1,NBOD
916 C
917 C Process measured body coordinates
918 C
919     IBOD=IBOD+1
920 590     IF (IBOD.GT.NBOD) GO TO 700
921     IF (XY(1,IBOD,1).LE.0) then
922         IBOD=IBOD+1
923         GO TO 590
924     ENDIF
925     KK=IBOD
926     XMAX=0.0D0
927     YMAX=0.0D0
928     XMIN=1000.0D0
929     YMIN=1000.0D0
930     SUMX=0.0D0
931     SUMY=0.0D0
932     DO 600 J=1,NRED
933         X=XY(1,IBOD,J)
934         Y=XY(2,IBOD,J)
935         IF (X.EQ.0.AND.Y.EQ.0) GO TO 610
936         SUMX=SUMX+X
937         SUMY=SUMY+Y
938         IF (NRED.EQ.1) GO TO 600
939         IF (XMAX.LT.X) XMAX=X
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
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```
940           IF (XMIN.GT.X) XMIN=X
941           IF (YMAX.LT.Y) YMAX=Y
942           IF (YMIN.GT.Y) YMIN=Y
```

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```

943 600    CONTINUE
944      IF (NRRED.NE.1) GO TO 620
945 610    XMIN=0.0D0
946      YMIN=0.0D0
947 620    J=NRRED
948      IF (J.EQ.0) J=1
949      X=SUMX/J
950      Y=SUMY/J
951      XM=XMAX-XMIN
952      YM=YMAX-YMIN
953      IDPT=IDBOD(IBOD)

954 C
955 C  Correct Measured Coordinates for Film Shrinkage
956 C
957      XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
958      YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
959 C
960      IF (NRRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
961      IF (NRRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
962      IF (NRRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
963      IF (NRRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT

964 C
965 C  Write Records for Triangulation Input to file: "img.dat"
966      WRITE ( 9,1610) IDPT,XT,YT,IFRAM(IANS)
967 690  CONTINUE
968 C
969 700  ican=0
970 710  write (*,*)' Re-do first fiducial'
971      READ (11) DATA
972      WRITE (*,*) CHAR(7)
973 C
974 C  DECODE data from CHARACTER to INTEGER
975 C
976      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
977      READ (DATA, 20) IBUTT,IX,IY
978      if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
979          write (*,*)' You blew it', ix, iy, ' vs.', isavex, isavey
980          WRITE (*,*) CHAR(7)
981          WRITE (*,*) CHAR(7)
982          ican=ican+1
983          if(ican.le.4) go to 710
984          write(*, *)'No more tries...origin lost...going back to menu'
985          WRITE (9,'(A8)') '*****'
986          go to 1
987      endif
988      PAUSE

```

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 SUBROUTINE BODY Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

989      WRITE (9,'(A8)') '*****'
990      go to 1
991 C
992 999  CALL CLEAR
993      WRITE (12,'(A8)') '*****'
994      WRITE ( 8,*)CHAR(12)
995      WRITE (10,*)CHAR(12)
996 C  FORMATTED OUTPUT FOR 132-COLUMN PAPER:
997 C
998 1370 FORMAT (2I1,8X,3F10.3)
999 1380 FORMAT (40X,'FIDUCIAL MEASUREMENTS OF FRAME ',A8// 36X,'ID',
1000      . 12X,'AVERAGE',13X,'MAX SPREAD'/48X,'X',9X,'Y',11X,'X',9X,'Y')

```

Anthropometry and Initial Conditions Photogrammetric Program

```

1001 1400 FORMAT (36X,'CALIBRATED FIDUCIAL COORDINATES OF FRAME ',A8//  

1002 . . . . . 46X, 'FID', 9X, 'X', 12X, 'Y' )  

1003 1410 FORMAT (2X,I4,4X,2F10.4)  

1004 1420 FORMAT (45X,I4,5X,F8.3,5X,F8.3)  

1005 1440 FORMAT (2D20.10)  

1006 1445 FORMAT (3D20.10)  

1007 1450 FORMAT (//42X,SP,'CALIBRATED FOCAL LENGTH = ',F9.3,' mm.')  

1008 1460 FORMAT (///51X,SP,'LENS DISTORTION'//51X,'RADIAL PARAMETERS'//31X  

1009 . . . . . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/51X'K3='D15.8D2  

1010 . . . . . ,//:45X,'LENS DECENTRATION PARAMETERS'//31X,'J1= 'D15.8D2,  

1011 . . . . . ' J2= 'D15.8D2,' PHI= 'D15.8D2/)  

1012 1470 FORMAT (I2)  

1013 1480 FORMAT (2F10.3)  

1014 1485 FORMAT (8X,'Calibrated Focal Length (CFL) in millimeters = ')  

1015 1500 FORMAT (44X,2F13.3)  

1016 1510 FORMAT (6X,I4,6F10.3)  

1017 1516 FORMAT (A8,2X,SP,F10.3:,SS,2(F10.3),10X)  

1018 1540 FORMAT (36X,I4,2X,2F10.3,2X,2F10.3)  

1019 1550 FORMAT (//138,'-PARAMETER RESIDUALS OF THE FIDUCIAL COORDINATES'//  

1020 . . . . . 43X, 'FID', 11X, 'X', 14X, 'Y' )  

1021 1560 FORMAT (42X,I4,2F15.3)  

1022 1570 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//22X,'ID',11X,  

1023 . . . . . 'MEASURED',13X,'ADJUSTED',13X,'MAX SPREAD',11X,'FRAME'//  

1024 . . . . . 34X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')  

1025 1575 FORMAT (//42X,'PLATE COORDINATES FOR FRAME ',A8//38X,'ID',11X,  

1026 . . . . . 'MEASURED',13X,'ADJUSTED'/50X,'X',9X,'Y',10X,'X',9X,'Y')  

1027 1580 FORMAT (2X,A8,6F10.3)  

1028 1600 FORMAT (18X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)  

1029 1605 FORMAT (34X,A8,2X,2F10.3,1X,2F10.3)  

1030 1610 FORMAT (A8,2X,2F10.4,15X,'Photo ',A8)  

1031 C  

1032 C FORMATTED OUTPUT FOR 80-COLUMN PAPER:  

1033 C  

1034 2380 FORMAT (20X,'Fiducial Measurements of Frame ',A8// 16X,'ID',12X,  

1035 . . . . . 'Average',13X,'Max Spread'/28X,'X',9X,'Y',11X,'X',9X,'Y')  

1036 2400 FORMAT (16X,'Calibrated Fiducial Coordinates of Frame ',A8//  

1037 . . . . . 26X, 'Fid', 9X, 'X', 12X, 'Y')

```

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SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

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```

1038 2420 FORMAT (25X,I4,5X,F8.3,5X,F8.3)  

1039 2450 FORMAT (//25X,SP,'Calibrated Focal Length = ',F9.3,' mm.')  

1040 2460 FORMAT (///31X,SP,'Lens Distortion'//31X,'Radial Parameters'//11X  

1041 . . . . . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/31X'K3='D15.8D2  

1042 . . . . . ,//:25X,'Lens Decentration Parameters'//11X,'J1= 'D15.8D2,  

1043 . . . . . ' J2= 'D15.8D2,' PHI= 'D15.8D2/)  

1044 2500 FORMAT (24X,2F13.3)  

1045 2540 FORMAT (16X,I4,2X,2F10.3,2X,2F10.3)  

1046 2550 FORMAT (//118,'-Parameter Residuals of the Fiducial Coordinates'//  

1047 . . . . . 23X, 'Fid', 11X, 'X', 14X, 'Y')  

1048 2560 FORMAT (22X,I4,2F15.3)  

1049 2570 FORMAT (//22X,'Plate Coordinates for Frame ',A8// 16X,'ID',11X,  

1050 . . . . . 'Measured',13X,'Adjusted',13X,'Max Spread',11X,'Frame'//  

1051 . . . . . 17X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')  

1052 2575 FORMAT (//22X,'Plate Coordinates for Frame ',A8//18X,'ID',11X,  

1053 . . . . . 'Measured',13X,'Adjusted'/30X,'X',9X,'Y',10X,'X',9X,'Y')  

1054 2600 FORMAT (X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)  

1055 2605 FORMAT (14X,A8,2X,2F10.3,1X,2F10.3)  

1056 C  

1057 CALL BEEP  

1058 CLOSE (8)

```

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```
1059      CLOSE (9)
1060      CLOSE (10)
1061      END
```

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SUBROUTINE FOURP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
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```
1062
1063      SUBROUTINE FOURP
1064  C
1065  C Calculate the 3 or 4 Parameter Transformation Between an Exact Set
1066  C      of Data and a Corresponding Set of Measured Data.
1067  C
1068      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1069      INTRINSIC DSQRT
1070      DIMENSION AM(2,4), CM(2)
1071      COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1072  C
1073      DO 1010 I=1,4
1074          DO 1010 J=1,5
1075              EQN(I,J)=0.0D0
1076  1010 CONTINUE
1077      AM(1,3)=1.0D0
1078      AM(1,4)=0.0D0
1079      AM(2,3)=0.0D0
1080      AM(2,4)=1.0D0
1081      DO 1030 I=1,NFID
1082          AM(1,1)=OBSCOR(1,I)
1083          AM(1,2)=OBSCOR(2,I)
1084          AM(2,1)=AM(1,2)
1085          AM(2,2)=-AM(1,1)
1086          CM(1)=CALCOR(1,I)
1087          CM(2)=CALCOR(2,I)
1088          DO 1020 J=1,4
1089              DO 1020 K=1,2
1090                  EQN(J,5)=EQN(J,5)+AM(K,J)*CM(K)
1091                  DO 1020 L=1,4
1092                      EQN(J,L)=EQN(J,L)+AM(K,J)*AM(K,L)
1093  1020 CONTINUE
1094  1030 CONTINUE
1095      CALL LINSOL(4)
1096      IF (ICH3.EQ.0) GO TO 1060
1097  C
1098  C If ICH3<>0 Transform the 4-param to a 3-param
1099  C
1100      SCALE=EQN(1,5)**2+EQN(2,5)**2
1101      SCALE=DSQRT(SCALE)
1102      EQN(1,5)=EQN(1,5)/SCALE
1103      EQN(2,5)=EQN(2,5)/SCALE
1104      SUM1=0.0D0
1105      SUM2=0.0D0
1106      DO 1050 I=1,NFID
1107          X=OBSCOR(1,I)
1108          Y=OBSCOR(2,I)
1109          SUM1=SUM1+CALCOR(1,I)-EQN(1,5)*X-EQN(2,5)*Y
1110          SUM2=SUM2+CALCOR(2,I)+EQN(2,5)*X-EQN(1,5)*Y
```

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SUBROUTINE FOURP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1111 1050 CONTINUE
1112   EQN(3,5)=SUM1/NFID
1113   EQN(4,5)=SUM2/NFID
1114 C
1115 C Form transformation parameters vector
1116 C
1117 1060 DEL(1)=EQN(1,5)
1118   DEL(2)=EQN(2,5)
1119   DEL(3)=EQN(3,5)
1120   DEL(4)=0.0D0
1121   DEL(5)=0.0D0
1122   DEL(6)=-DEL(2)
1123   DEL(7)=DEL(1)
1124   DEL(8)=EQN(4,5)
1125 END
```

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SUBROUTINE FIVEP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1126
1127      SUBROUTINE FIVEP
1128 C
1129 C Calculate the FIVE Parameter Transformation Between an Exact Set
1130 C      of Data and a Corresponding Set of Measured Data.
1131 C
1132      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1133      INTRINSIC DSIN, DCOS, DABS
1134      DIMENSION B(2,5),C(2),CV(5),PAR(5)
1135      COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1136 C
1137      PAR(1)=DSQRT(DEL(1)**2+DEL(2)**2)
1138      PAR(2)=PAR(1)
1139      PAR(3)=DATAN2(DEL(2),DEL(1))
1140      PAR(4)=DEL(3)
1141      PAR(5)=DEL(8)
1142      B(1,2)=0.0D0
1143      B(1,5)=0.0D0
1144      B(2,1)=0.0D0
1145      B(2,4)=0.0D0
1146      DO 30 II=1,10
1147      DO 2 I=1, 5
1148          CV(I)=0.0D0
1149          DO 2 J=1, 5
1150      2 EQN(I, J)=0.0D0
1151      DO 10 I=1,NFID
1152          B(1,4)=PAR(1)
1153          B(2,5)=PAR(2)
1154          SINT=DSIN(PAR(3))
1155          COST=DCOS(PAR(3))
1156          X=OBSCOR(1,I)
1157          Y=OBSCOR(2,I)
1158          C1=-X*SINT+Y*COST
1159          C2= X*COST+Y*SINT
1160          B(1,1)=C2*PAR(1)
1161          B(1,3)=C1*PAR(1)**2
1162          B(2,2)=C1*PAR(2)
1163          B(2,3)=-C2*PAR(2)**2
```

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```

1164      C(1)=PAR(1)*(CALCOR(1,I)-PAR(1)*C2-PAR(4))
1165      C(2)=PAR(2)*(CALCOR(2,I)-PAR(2)*C1-PAR(5))
1166      DO 10 J=1,5
1167      DO 10 K=1,2
1168      CV(J)=CV(J)+B(K,J)*C(K)
1169      DO 10 L=1,5
1170      EQN(J,L)=EQN(J,L)+B(K,J)*B(K,L)
1171 10      CONTINUE
1172 C
1173 C   Solve normal equations
1174 C
1175      CALL LINSOL(5)

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
 SUBROUTINE FIVEP Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

1176      DO 15 J=1, 5
1177 15      PAR(J)=PAR(J)+EQN(J, 6)
1178 C
1179 C   Test for convergence
1180 C
1181      DO 20 J=1, 5
1182      C1=DABS(EQN(J, 6))
1183      EPSLN=1.0D-6
1184      IF(J.GT.3)EPSLN=1.0D-4
1185      IF(C1.GT.EPSLN)GO TO 30
1186 20      CONTINUE
1187      GO TO 40
1188 30      CONTINUE
1189      CALL CLEAR
1190      CALL BEEP
1191      WRITE(*,*)' Error in FIVEP'
1192      STOP
1193 C
1194 C   Form transformation parameters vector
1195 C
1196 40      SINT=DSIN(PAR(3))
1197      COST=DCOS(PAR(3))
1198      DEL(1)=PAR(1)*COST
1199      DEL(2)=PAR(1)*SINT
1200      DEL(3)=PAR(4)
1201      DEL(4)=0.0D0
1202      DEL(5)=0.0D0
1203      DEL(6)=-PAR(2)*SINT
1204      DEL(7)=PAR(2)*COST
1205      DEL(8)=PAR(5)
1206      END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
 SUBROUTINE SIXP Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

1207
1208      SUBROUTINE SIXP
1209 C
1210 C   Calculate the SIX Parameter Transformation Between an Exact Set
1211 C   of Data and a Corresponding Set of Measured Data.
1212 C
1213      IMPLICIT DOUBLE PRECISION (A-H,O-Z)

```

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Anthropometry and Initial Conditions Photogrammetric Program

```
1214      DIMENSION ANS(2,3), CCC(3,3), DDD(3,2), RRR(2,2), ERR(2)
1215      COMMON    CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1216 C
1217 C Zero Normal Equation Area.
1218 C
1219      DO 1010 I=1,2
1220          DO 1010 J=1,3
1221              CCC(I,J)=0.0D0
1222              DDD(J,I)=0.0D0
1223      1010 CONTINUE
1224 C
1225 C Compute Normal Equations
1226 C
1227      DO 1020 I=1,NFID
1228          DO 1020 J=1,2
1229              CCC(J,3)=CCC(J,3)+CALCOR(J,I)
1230              DDD(3,J)=DDD(3,J)+OBSCOR(J,I)
1231          DO 1020 K=1,2
1232              CCC(J,K)=CCC(J,K)+CALCOR(J,I)*CALCOR(K,I)
1233              DDD(J,K)=DDD(J,K)+CALCOR(J,I)*OBSCOR(K,I)
1234      1020 CONTINUE
1235      CCC(3,1)=CCC(1,3)
1236      CCC(3,2)=CCC(2,3)
1237      CCC(3,3)=NFID
1238 C
1239 C Compute Inverse of Normal Matrix.
1240 C
1241      IGGY=3
1242      CALL INVERT (CCC,IGGY,DET)
1243 C
1244 C Compute the Transformation Parameters
1245 C
1246      DO 1030 I=1,2
1247          DO 1030 J=1,3
1248              ANS(I,J)=0.0D0
1249          DO 1030 K=1,3
1250      1030      ANS(I,J)=ANS(I,J)+CCC(J,K)*DDD(K,I)
1251 C
1252 C Calculate the Transformation from Measured Data to Exact Data.
1253 C
1254      DO 1040 I=1,2
1255          DO 1040 J=1,2
```

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SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1256      1040      RRR(I,J)=ANS(I,J)
1257      IGGY=2
1258      CALL INVERT (RRR,IGGY,DET)
1259      DO 1050 I=1,2
1260          DO 1050 J=1,2
1261      1050      ANS(I,J)=RRR(I,J)
1262          DO 1060 I=1,2
1263      1060      ERR(I)=-ANS(I,1)*ANS(1,3)-ANS(I,2)*ANS(2,3)
1264          DO 1070 I=1,2
1265      1070      ANS(I,3)=ERR(I)
1266 C
1267 C Form transformation parameters vector
1268 C
1269      DEL(1)=ANS(1,1)
1270      DEL(2)=ANS(1,2)
1271      DEL(3)=ANS(1,3)
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```
1272      DEL(4)=0.0D0
1273      DEL(5)=0.0D0
1274      DEL(6)=ANS(2,1)
1275      DEL(7)=ANS(2,2)
1276      DEL(8)=ANS(2,3)
1277      END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1278
1279      SUBROUTINE EIGHTP
1280      C
1281      C Calculate the EIGHT Parameter Transformation Between an Exact Set
1282      C      of Data and a Corresponding Set of Measured Data.
1283      C
1284      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1285      INTRINSIC DABS
1286      COMMON   CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1287      real*8   tem(8)
1288      C
1289      C Zero the matrix of linear equations EQN
1290      C
1291      DO 1 I=1,8
1292      del(i)=0.0d0
1293      DO 1 J=1,9
1294      1 EQN(I,J)=0.0D0
1295      C
1296      C Compute approximate values for the transformation parameters
1297      C
1298      DO 10 I=1,NFID
1299      10 CALL ACCAPR (CALCOR(1,I),CALCOR(2,I),OBSCOR(1,I),OBSCOR(2,I))
1300      N=8
1301      call invert(eqn, n, d)
1302      do 15 i=1, 8
1303      do 15 j=1, 8
1304      15 del(i)=del(i)+eqn(i, j)*eqn(j, 9)
1305      C
1306      C Compute the transformation parameters by least squares
1307      C
1308      DO 50 M=1,5
1309      C
1310      C Zero the normal equations
1311      C
1312      DO 18 I=1,8
1313      tem(i)=0.0d0
1314      DO 18 J=1,9
1315      18 EQN(I,J)=0.0D0
1316      C
1317      C Form the normal equations
1318      C
1319      DO 20 I=1,NFID
1320      20 CALL ACCNEQ (CALCOR(1,I),CALCOR(2,I),OBSCOR(1,I),OBSCOR(2,I))
1321      C
1322      C Solve the normal equations
1323      C
1324      call invert(eqn, n, d)
1325      do 25 i=1, 8
1326      do 25 j=1, 8
```

Anthropometry and Initial Conditions Photogrammetric Program

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SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1327 25      tem(i)=tem(i)+eqn(i, j)*eqn(j, 9)
1328 C
1329 C  Correct the approximate values of the transformation parameters
1330 C
1331      do 30 i=1, 8
1332 30      del(i)=del(i)+tem(i)
1333 C
1334 C  Test the solution for convergence
1335 C
1336      DO 40 I=1,8
1337          D=DABS(DEL(I)/(DEL(I)-tem(I))-1.0)
1338          IF (D.GT..001D0) GO TO 50
1339 40      CONTINUE
1340      RETURN
1341 50      CONTINUE
1342      END
```

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SUBROUTINE LINSOL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1343
1344      SUBROUTINE LINSOL(NPAR)
1345 C
1346 C  Solution of (NPAR) linear equations in (NPAR) unknowns.
1347 C
1348      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1349      COMMON CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1350 C
1351      DO 1040 K=1,NPAR
1352          M=NPAR+1
1353          DO 1010 J=K,NPAR+1
1354              EQN(K,M)=EQN(K,M)/EQN(K,K)
1355 1010          M=M-1
1356          DO 1030 I=1,NPAR
1357              IF (I.EQ.K) GO TO 1030
1358              M=NPAR+1
1359              DO 1020 L=K,NPAR+1
1360                  EQN(I,M)=EQN(I,M)-EQN(I,K)*EQN(K,M)
1361 1020          M=M-1
1362 1030      CONTINUE
1363 1040      CONTINUE
1364 C
1365      END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE ACCAPR Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1366
1367      SUBROUTINE ACCAPR (XG,YG,XP,YP)
1368 C
1369 C  Evaluate the contribution of one point to the 8 by 9 matrix of
1370 C  normal equations for computation of approximate values of the
1371 C  eight-parameter film shrinkage transformation.
```

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```

1372 C
1373 C XG: Calibrated X Fiducial coordinate
1374 C YG: Calibrated Y Fiducial coordinate
1375 C XP: Observed X Fiducial coordinate
1376 C YP: Observed Y Fiducial coordinate
1377 C EQN: 8 X 8 Coefficient matrix of the Normal Equation
1378 C with the vector of constants in column 9.
1379 C
1380 IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1381 DIMENSION AM(2,8), BM(2)
1382 COMMON CALCOR(2,50), OBSCOR(2,50), EQN(8,9), DEL(8), ICH3, NFID
1383 C
1384 AM(1,1)=XP
1385 AM(1,2)=YP
1386 AM(1,3)=1.0D0
1387 AM(1,4)=-XG*XP
1388 AM(1,5)=-YG*YP
1389 AM(1,6)=0.0D0
1390 AM(1,7)=0.0D0
1391 AM(1,8)=0.0D0
1392 AM(2,1)=0.0D0
1393 AM(2,2)=0.0D0
1394 AM(2,3)=0.0D0
1395 AM(2,4)=-XP*YG
1396 AM(2,5)=-YP*YG
1397 AM(2,6)=XP
1398 AM(2,7)=YP
1399 AM(2,8)=1.0D0
1400 BM(1)=XG
1401 BM(2)=YG
1402 DO 1010 I=1,8
1403 DO 1010 J=1,8
1404 DO 1010 K=1,2
1405 1010 EQN(I,J)=EQN(I,J)+AM(K,I)*AM(K,J)
1406 DO 1020 I=1,8
1407 DO 1020 J=1,2
1408 1020 EQN(I,9)=EQN(I,9)+AM(J,I)*BM(J)
1409 C
1410 END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
 SUBROUTINE ACCNEQ Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

1411
1412 SUBROUTINE ACCNEQ (XG,YG,XP,YP)
1413 C
1414 C Evaluate the contribution of one point to the normal equation
1415 C required for Subroutine EIGHT. The normal equations are
1416 C required to compute corrections to the last estimate of the
1417 C eight transformation parameters. This is called once for each
1418 C point.
1419 C
1420 C XG: Calibrated X Fiducial coordinate
1421 C YG: Calibrated Y Fiducial coordinate
1422 C XP: Observed X Fiducial coordinate
1423 C YP: Observed Y Fiducial coordinate
1424 C EQN: 8 X 8 Coefficient matrix of the Normal Equation
1425 C with the vector of constants in column 9.
1426 C
1427 C
1428 IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1429 DIMENSION AM(2,2), BM(2,8), CM(2), AMM(2,2)

```

Anthropometry and Initial Conditions Photogrammetric Program

```

1430      COMMON      CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1431  C
1432      AM(1,1)=DEL(1)-XG*DEL(4)
1433      AM(1,2)=DEL(2)-XG*DEL(5)
1434      AM(2,1)=DEL(6)-YG*DEL(4)
1435      AM(2,2)=DEL(7)-YG*DEL(5)
1436      BM(1,1)=XP
1437      BM(1,2)=YP
1438      BM(1,3)=1.0D0
1439      BM(1,4)=-XP*XG
1440      BM(1,5)=-YP*XG
1441      BM(1,6)=0.0D0
1442      BM(1,7)=0.0D0
1443      BM(1,8)=0.0D0
1444      BM(2,1)=0.0D0
1445      BM(2,2)=0.0D0
1446      BM(2,3)=0.0D0
1447      BM(2,4)=-XP*YG
1448      BM(2,5)=-YP*YG
1449      BM(2,6)=XP
1450      BM(2,7)=YP
1451      BM(2,8)=1.0D0
1452      CM(1)=XP*AM(1,1)+YP*AM(1,2)+DEL(3)-XG
1453      CM(2)=XP*AM(2,1)+YP*AM(2,2)+DEL(8)-YG
1454  C
1455  C  Form modified covariance matrix AMM
1456  C
1457      DO 10 I=1,2
1458          DO 10 J=1,2
1459              AMM(I,J)=0.0D0

```

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 SUBROUTINE ACCNEQ Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

1460      DO 10 K=1,2
1461          AMM(I,J)=AMM(I,J)+AM(I,K)*AM(J,K)
1462      10  CONTINUE
1463          D=AMM(1,1)*AMM(2,2)-AMM(1,2)*AMM(2,1)
1464          AM(1,1)= AMM(2,2)/D
1465          AM(2,2)= AMM(1,1)/D
1466          AM(1,2)=-AMM(2,1)/D
1467          AM(2,1)= AMM(1,2)
1468  C
1469  C  Form normal equations
1470  C
1471      DO 20 I=1,8
1472          DO 20 J=1,8
1473              DO 20 K=1,2
1474                  DO 20 L=1,2
1475                      EQN(I,J)=EQN(I,J)+BM(K,I)*AM(K,L)*BM(L,J)
1476      20  CONTINUE
1477          DO 30 I=1,8
1478              DO 30 K=1,2
1479                  DO 30 L=1,2
1480                      EQN(I,9)=EQN(I,9)-BM(K,I)*AM(K,L)*CM(L)
1481      30  CONTINUE
1482      END

```

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SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1483  
1484  
1485      SUBROUTINE INVERT (A,N,D)  
1486  C  
1487  C  Find the Inverse of a Matrix by the Gaussian Elimination Method.  
1488  C  A: Array in which the matrix to be inverted is located.  
1489  C  The routine will search for the largest non-singular matrix in  
1490  C  the array A and invert it & return it in the same locations of A.  
1491  C  N: The first dimension of A. It must be a variable in the call list.  
1492  C  The rank of largest matrix contained in A will be returned in N.  
1493  C  D: The determinant of the largest non-singular matrix in A.  
1494  C  L & M: Vectors of dimension N used temporarily.  
1495  C  
1496  C  
1497      IMPLICIT DOUBLE PRECISION (A-H,O-Z)  
1498      INTRINSIC DABS  
1499      DIMENSION A(64), L(8), M(8)  
1500  C  
1501  C  Initiate the continued product of pivots becoming the determinant.  
1502  C  
1503      D=1.0D0  
1504  C  
1505  C  Initiate the counter which contains the rank of the matrix.  
1506  C  
1507      KSAVE=0  
1508  C  
1509  C  Start the main elimination loop.  
1510  C  
1511      DO 1090 K=1,N  
1512  C  
1513  C  Search for the largest element  
1514  C  
1515      L(K)=K  
1516      M(K)=K  
1517      KK=K+N*(K-1)  
1518      BIGA=A(KK)  
1519      DO 1010 I=K,N  
1520          DO 1010 J=K,N  
1521          IJ=I+N*(J-1)  
1522          IF (DABS(BIGA).GE.DABS(A(IJ))) GO TO 1010  
1523          BIGA=A(IJ)  
1524          L(K)=I  
1525          M(K)=J  
1526  1010      CONTINUE  
1527  C  
1528  C  Largest element of zero means the largest matrix in A is less than N.  
1529  C  
1530      IF (BIGA.EQ.0) GO TO 1100  
1531  C  
1532  C  Interchange rows
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1533  C  
1534      J=L(K)  
1535      KSAVE=K  
1536      IF (L(K).LE.K) GO TO 1030
```

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```
1537      DO 1020 I=1,N
1538          KI=K+N*(I-1)
1539          JI=J+N*(I-1)
1540          tem=-a(ki)
1541          a(ki)=a(ji)
1542          a(ji)=tem
1543 1020      CONTINUE
1544 C
1545 C Interchange columns.
1546 C
1547 1030      I=M(K)
1548      IF (M(K).LE.K) GO TO 1050
1549      DO 1040 J=1,N
1550          JK=J+N*(K-1)
1551          JI=J+N*(I-1)
1552          tem=-a(jk)
1553          a(jk)=a(ji)
1554          a(ji)=tem
1555 1040      CONTINUE
1556 C
1557 C Divide column by minus pivot
1558 C
1559 1050      DO 1060 I=1,N
1560          IF (I.EQ.K) GO TO 1060
1561          IK=I+N*(K-1)
1562          A(IK)=A(IK)/(-A(KK))
1563 1060      CONTINUE
1564 C
1565 C Reduce matrix
1566 C
1567      DO 1070 I=1,N
1568          DO 1070 J=1,N
1569          IF (I.EQ.K.OR.J.EQ.K) GO TO 1070
1570          IJ=I+N*(J-1)
1571          IK=I+N*(K-1)
1572          KJ=K+N*(J-1)
1573          A(IJ)=A(IK)*A(KJ)+A(IJ)
1574 1070      CONTINUE
1575 C
1576 C Divide row by pivot
1577 C
1578      DO 1080 J=1,N
1579          IF (J.EQ.K) GO TO 1080
1580          KJ=K+N*(J-1)
1581          A(KJ)=A(KJ)/A(KK)
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1582 1080      CONTINUE
1583 C
1584 C Continued product of pivots
1585 C
1586          D=D*A(KK)
1587          A(KK)=1.000/A(KK)
1588 1090 CONTINUE
1589 C
1590 C Final row and column interchange
1591 C
1592 1100 K=KSAVE+1
1593 1110 K=K-1
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```
1594      IF (K.LE.0) GO TO 1150
1595  C
1596  C Restore columns.
1597  C
1598      I=L(K)
1599      IF (I.LE.K) GO TO 1130
1600      DO 1120 J=1,N
1601          JK=J+N*(K-1)
1602          JI=J+N*(I-1)
1603          tem=A(jk)
1604          A(JK)=-A(JI)
1605          A(ji)=tem
1606      1120 continue
1607  C
1608  C Restore rows.
1609  C
1610      1130 J=M(K)
1611      IF (J.LE.K) GO TO 1110
1612      DO 1140 I=1,N
1613          KI=K+N*(I-1)
1614          JI=J+N*(I-1)
1615          tem=A(ki)
1616          A(KI)=-A(JI)
1617          A(ji)=tem
1618      1140 continue
1619      GO TO 1110
1620  C
1621  C Set the rank of the matrix and return to the calling routine.
1622  C
1623  1150 RETURN
1624  END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE NEWPAG Compiling Options:
/N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1625
1626      SUBROUTINE NEWPAG
1627  C
1628  C Generate page titles for GIANT system, insert Form Feed whether the
1629  C FORTRAN compiler supports it or not. (Hewlett-Packard 9000 doesn't)
1630  C
1631      INTRINSIC CHAR
1632      CHARACTER FF*1, JTITLE*42
1633      COMMON /TITLEP/ JTITLE, I    Page
1634  C
1635      FF=CHAR(12)
1636      I    Page=I    Page+1
1637      IF (I    Page .GT. 0) THEN
1638          WRITE ( 8,1010) FF,JTITLE,I    Page
1639          WRITE (10,1020) FF,I    Page,JTITLE
1640      ENDIF
1641  1010 FORMAT(A,' NBDL H-P UNIX GIANT X-PREP :',3X,A80,3X,'    Page',I5//)
1642  1020 FORMAT(A,' NBDL H-P UNIX GIANT X-PREP :',38X,'    Page',I3/1X,A42/)
1643      END
```

Anthropometry and Initial Conditions Photogrammetric Program

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SUBROUTINE BEEP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1644
1645      SUBROUTINE BEEP
1646  C
1647  C This routine causes a "beep" sound when called. (ANSI terminals)
1648  C
1649      CHARACTER*1 BEEP
1650      INTRINSIC CHAR
1651      BEEP=CHAR(7)
1652      WRITE (*,'(1X,A1)') BEEP
1653      END
```

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SUBROUTINE CLEAR Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1654
1655      SUBROUTINE CLEAR
1656      CALL CLR
1657      CALL TOPLFT
1658      CALL CURDWN (8)
1659      END
```

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SUBROUTINE CLR Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1660
1661      SUBROUTINE CLR
1662  C
1663  C This routine erases the screen and the cursor goes to the home position
1664  C (ANSI)      STRING = ESC [ 2 J
1665  C
1666      CHARACTER*1 ESC,BKT,TWO,J,STRING*4
1667      INTRINSIC CHAR
1668      ESC=CHAR(27)
1669      BKT=CHAR(91)
1670      TWO=CHAR(50)
1671      J=CHAR(74)
1672      STRING=ESC//BKT//TWO//J
1673      WRITE (*,'(1X,A4)') STRING
1674      END
```

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SUBROUTINE CURDWN Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1675
1676      SUBROUTINE CURDWN (IROW)
1677  C
1678  C This routine moves the cursor down IROW lines without changing column
1679  C (ignored if the cursor is already at the bottom of the screen)
1680  C (ANSI)
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```
1681 C
1682     CHARACTER*1 ESC,BKT,B
1683     CHARACTER*2 ESCBKT
1684     INTRINSIC CHAR
1685     ESC=CHAR(27)
1686     BKT=CHAR(91)
1687     ESCBKT=ESC//BKT
1688     B=CHAR(66)
1689     IF (IROW.LT.10) WRITE (*,'(1X,A2,I1,A1,/)') ESCBKT,IROW,B
1690     IF (IROW.GE.10) WRITE (*,'(1X,A2,I2,A1,/)') ESCBKT,IROW,B
1691     END
```

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SUBROUTINE TOPLFT Compiling Options:
/N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1692
1693     SUBROUTINE TOPLFT
1694 C
1695 C Move the cursor to the top left of the scrolling region.(ANSI)
1696 C
1697     CHARACTER*1 ESCAPE,L_BRACKET,SEMICOLON,H
1698     CHARACTER*2 ESCBKT
1699     INTRINSIC CHAR
1700     ESCAPE=CHAR(27)
1701     L_BRACKET=CHAR(91)
1702     ESCBKT=ESCAPE//L_BRACKET
1703     SEMICOLON=CHAR(59)
1704     H=CHAR(72)
1705     N=1
1706     WRITE (*,'(1X,A2,I1,A1,I1,A1,/)') ESCBKT,N,SEMICOLON,N,H
1707     END
```

NPREP Program listing

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
PROGRAM DIGITIZE_GIANT_IMAGE_DATA_FILE Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

Page 1

```
1 PROGRAM Digitize_Giant_Image_Data_File
2 cccc
3 c c     Altek digitizer 4-button key control meanings:
4 c c             #2:RED = error-backup
5 c c             #4:BLUE=abort photo      #1:YELLOW=missing
6 c c             #3:GREEN=fiducial or data point
7 cccc
8 common /titlep/ title, page, out, img, dig
9 character*74 title, irun*6, fn*12, day*8
10 integer page, out, img, dig
11 call SYSTEM ('cls')
12 page=0
13 out=1
14 img=2
15 dig=3
16 write (*,*) 'Enter COMM Port number: '
17 read (*,*) icmm
18 icmm=icmm+48
19 call SYSTEM ('mode com//char(icmm)///:9600,o,7,2')
20 open (dig,file = 'com//char(icmm), access='transparent')
21 call DATE (day)
22 c
23 write(*,*) 
24 write(*,*)'Enter 0 for initial conditions'
25 write(*,*)'Enter 1 for head anthropometry'
26 write(*,*)'Enter 2 for body anthropometry'
27 write(*,*) 
28 read (*,*)ians
29 if(ians==0)then
30 1     write (*,*) 
31     write (*,*)'Enter RUN number (A6): '
32     read (*,*) irun
33     write(*,*) 
34     do i=1,6
35         if(irun(i:i)==' ')go to 1
36     enddo
37     open (out,file =irun//pr.out', status='new')
38     open (img,file =irun//im.dat', status='new')
39     write (title,"(' Initial Conditions for Run # ',a6,24x,' Date:'
40                 ,a8") irun, day
41     call HEADS(ians)
42 else
43     write (*,*) 'Enter HRV number: '
44     read (*,*) ihrv
45     write (*,*) 
46     if(ians==1)then
47         write (*,*) 'Default ear offsets are: 5.420", 5.420". ok?'
48         write (*,*) 'Hit RETURN to accept. Any other key to change'
49         write (*,*) 
50         i=ixkey()
51         if (i/=13) then
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 PROGRAM DIGITIZE_GIANT_IMAGE_DATA_FILE Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

52         write (*,*) 'Enter left & right ear offsets: '
53         read (*,*) ol, or
54         write (*,*) 
55     else
56         ol=5.420
57         or=5.420
58     endif
59     write (fn, '(i4.4, ''head.out'')') ihrv
60     open (out,file =fn, status='new')
61     write (fn, '(i4.4, ''himg.dat'')') ihrv
62     open (img,file =fn, status='new')
63     write (img, *) ol, or
64     write (title,"(' Head Anthropometry for HRV # ',i5.5,
65             23x,' Date: ', a8)") ihrv, day
66     call HEADS(ians)
67     elseif(ians==2)then
68         write (fn, '(i4.4, ''body.out'')') ihrv
69         open (out,file =fn, status='new')
70         write (fn, '(i4.4, ''bimg.dat'')') ihrv
71         open (img,file =fn, status='new')
72         write (title,"(' Body Anthropometry for HRV # ',i5.5,
73             23x,' Date: ', a8)") ihrv, day
74         call BODY
75     endif
76     endif
77     write (*,*) 
78 end

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 SUBROUTINE HEADS Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

79
80     SUBROUTINE HEADS(ians)
81     c     ians=0      Digitize Initial Conditions For Accelerator Run
82     c     ians=1      Digitization Of Head Anthropometry
83     c
84     c     Revised January 25, 1992 by D. Francis
85     c
86     implicit real*8 (a-h,o-z)
87     common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
88     common /titlep/ title, page, out, img, dig
89     character*74 title
90     integer    page, out, img, dig, icm(6)
91     character  data*17
92     character*8 ifram(14), ilab(12), icont(35), itarg(40)
93     integer    ibutt, ifid, ix, iy
94     real*8     xy(2,33), calfid(2,4,8), foc(8), fk(4,8), xo(2,8)
95     data ilab /' top 1',' top 2',' top 3',' rt 1',
96             ' rt 2',' rt 3',' bot 1',' bot 2',
97             ' bot 3',' lft 1',' lft 2',' lft 3'/
98     data icont /' a',' b',' c',' d',
99             ' e',' f',' g',' h',
100            ' i',' j',' k',
101            ' rtc1',' rtc2',' rtc3',' rtc4',
102            ' rtc5',' rtc6',' rtc7',' rtc8',
103            ' cen1',' cen2',' cen3',' cen4',
104            ' cen5',' cen6',' cen7',' cen8',

```

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Anthropometry and Initial Conditions Photogrammetric Program

```

105      .      , lfc1', , lfc2', , lfc3', , lfc4', ,
106      .      , lfc5', , lfc6', , lfc7', , lfc8', ,
107      data itarg // m_r1', , m_r4', , m_t1', , m_t4', ,
108      . , m_b1', , m_b4', , m_l1', , m_l4', , t_r1', ,
109      . , t_r4', , t_c1', , t_c4', , t_l1', , t_l4', ,
110      . , mtar01', , mtar03', , mtar06', , mtar07', , mtar08', ,
111      . , mtar09', , mtar11', , htar02', , htar03', , htar04', ,
112      . , htar11', , htar13', , htar14', ,
113      .
114      . , rtp', , ctp', , ltp', , ron', , lon', ,
115      . , ear1-r', , ear2-r', , ear3-r', , ear4-r', ,
116      . , ear1-l', , ear2-l', , ear3-l', , ear4-l', ,
117      data ifram // #1', , #2', , #3', ,
118      . , #4', , #5', , #6', ,
119      . , #1-580', , #2-736', , #3-674', , #4-623', ,
120      . , #5-591', , #6-806', , #7-074', , #8-799', ,
121      data foc / -55.003d0, -55.003d0, -55.005d0, -55.004d0,
122      . , -55.002d0, -55.005d0, -55.001d0, -55.004d0/
123      data calfid/18.1126, -12.1263, 18.1047, 12.1259, -18.1199, 12.1311,
124      . , -18.1053, -12.1263, 18.1162, -12.1319, 18.1186, 12.1364,
125      . , -18.1264, 12.1387, -18.1118, -12.1319,
126      . , 18.1101, 12.1239, -18.1170, 12.1277, -18.1071, -12.1219,
127      . , 18.1023, -12.1271, 18.1098, 12.1178, -18.1089, 12.1315,
128      . , -18.1237, -12.1271, 18.1302, -12.1250, 18.1230, 12.1361,
129      . , -18.1178, 12.1167, -18.1064, -12.1250, 18.1055, -12.1224,
130      . , 18.1109, 12.1266, -18.1340, 12.1414, -18.1046, -12.1224,
131      . , 18.1208, -12.1289, 18.1323, 12.1450, -18.1405, 12.1421,

```

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 SUBROUTINE HEADS Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

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Source file Listing

```

132      .      , -18.1083, -12.1289, 18.0867, -12.1120, 18.1023, 12.1168,
133      .      , -18.0823, 12.1091, -18.0953, -12.1120/
134      c Radial Lens Distortion Coefficients FK0, FK1, FK2, FK3
135      data fk /1.924312d-04, -2.839673d-06, 1.940416d-08, -4.715753d-11,
136      .      , 6.467923d-04, -1.301398d-05, 7.699424d-08, -1.413951d-10,
137      .      , 5.920576d-04, -1.120280d-05, 6.877133d-08, -1.358581d-10,
138      .      , 7.242229d-04, -1.395773d-05, 8.152970d-08, -1.488803d-10,
139      .      , 3.126069d-04, -7.650029d-06, 5.678321d-08, -1.212948d-10,
140      .      , 7.208347d-04, -1.328443d-05, 7.942249d-08, -1.541224d-10,
141      .      , 2.566426d-05, -8.466813d-07, 1.618407d-08, -5.114144d-11,
142      .      , 6.696901d-04, -1.176637d-05, 6.149184d-08, -1.050377d-10/
143      c Offsets
144      data xo / -0.005, -0.022, 0.027, 0.088, 0.037, 0.088,
145      .      , -0.056, 0.132, 0.013, 0.122, 0.045, 0.036,
146      .      , -0.005, -0.022, 0.019, 0.140/
147      c Cameras assigned to each photo number
148      data icm /1, 2, 3, 4, 5, 6/
149      ncont=35
150      c 27 for initial conditions (ians=0) & 13 for head anthro (ians=1)
151      jt=27*ians
152      ntarg=27
153      if(ians==1) ntarg = 13
154      units=.001d0
155      sdx = .055d0
156      sdy = .055d0
157      c
158      1 write (*,*) ' Enter Photo # (1-6, 0 when finished) '
159      read (*,*) ipho
160      call CLEAR
161      if(ipho==0) go to 999
162      c
163      icam=icm(ipho)
164      focal= foc(icam)

```

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```

165      call NEWPAG
166      write (out,2) ifram(ipho)
167 2   format (16x,'Calibrated Fiducial Coordinates of Frame ',a8//,
168      .           26x, 'Fid', 9x, 'X', 12x, 'Y')
169  c
170  c  Write Calibrated Fiducial Coordinates
171  c
172      do ifid=1, 4
173      write (out,4) ifid,calfid(1,ifid,icam),calfid(2,ifid,icam)
174  4   format (25x,i4,5x,f8.3,5x,f8.3)
175      enddo
176      write (out,8) focal, xo(1,icam),xo(2,icam)
177  8   format (//sp,' Calibrated Focal Length = ',f9.3,' mm.  Xoff= ',
178      .           f7.3,' mm.  Yoff= ',f7.3,' mm.')
179      write (out,10) (fk(i,icam), i=1,4)
180  10  format (///31x,sp,'Lens Distortion'/31x,'Radial Parameters'/11x
181      . 'K0='d15.8d2,' K1='d15.8d2,' K2='d15.8d2/31x'K3='d15.8d2//')
182  c
183  c  Read & Write Frame ID
184  c

```

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SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

185      write (img,12) ifram(ipho), focal, sdx, sdy,ifram(icam+6)
186  12  format (a8,2x,sp,f10.3:,ss,2(f10.3),a8,2x)
187      call NEWPAG
188      write (out,14) ifram(ipho)
189  14  format (20x,'Fiducial Measurements of Frame ',a8// 24x,'ID',12x,
190      . 'Measured'/37x,'X',14x,'Y')
191
192  c ****
193  c  Digitize edges:
194      ifid=1
195  20  write (*,*) 'Enter: ', ilab(ifid)
196      read (dig) data
197      write (*,*) char(7)
198  c
199  c  DECODE data from CHARACTER to INTEGER
200      if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
201      read (data, 50) ibutt,ix,iy
202  50  format (i1,1x,i6,1x,i6)
203  c
204  c  Interpret action to take based on which button was pressed:
205      if (ibutt == 3) then          ! good
206          xy(1,ifid)=ix*units
207          xy(2,ifid)=iy*units
208          ifid=ifid+1
209      elseif (ibutt == 2) then      ! error - backup
210          ifid=ifid-1
211          write (*,*) 'Backing up one to ',ilab(ifid)
212          write (*,*) char(7),char(7)
213      else
214          write (*,*) 'Not an option. Redo'
215      endif
216      if (ifid <= 12) go to 20
217  c
218  c  Find the fiducials from these edges
219      call FID(XY)           ! 12 in & 4 out
220      nfid=4
221  c
222  c  Store observed (digitized) coordinates
223      do ifid=1,4

```

Anthropometry and Initial Conditions Photogrammetric Program

```
224      do i=1,2
225          obscor(i,ifid)=xy(i,ifid)
226          calcor(i,ifid)=calfid(i,ifid,icam)
227      enddo
228      write (out,64) ifid,xy(1,ifid),xy(2,ifid)
229  64      format (22x,i4,2f15.3)
230      enddo
231  c
232  c Compute the 4-Parameter Check Transformation.
233  c
234      ich3=0
235      call FOURP
236      write (*,*)' 4-Parameter Check Transformation'
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

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Source file Listing

```
237      rmsx=0.
238      rmsy=0.
239      do i=1,4
240          x=obscor(1,i)
241          y=obscor(2,i)
242          dn=(x*del(4)+y*del(5)+1.0)
243          xt=(x*del(1)+y*del(2)+del(3))/dn-calc(1,i)
244          yt=(x*del(6)+y*del(7)+del(8))/dn-calc(2,i)
245          write (*,64) i,xt,yt
246          rmsx=rmsx+xt*xt
247          rmsy=rmsy+yt*yt
248      enddo
249      rmsx3=dsqrt(rmsx/nfid)
250      rmsy3=dsqrt(rmsy/nfid)
251      write (*,'('' rms= '',2f7.3/)'')rmsx3, rmsy3
252      write (*,*)'8-Parameter Transformation'
253      rmsx=0.
254      rmsy=0.
255  c
256  c Compute the Multi-Parameter Transformation.
257      call EIGHTP
258      write (out,66)
259  66      format (//17x,'8-Parameter Residuals of the Fiducial Coordinates'/
260                  .               / 23x, 'Fid', 11x, 'X', 14x, 'Y')
261  c
262  c Compute Residuals For the Fiducial Coordinates
263  c
264      do i=1,4
265          x=obscor(1,i)
266          y=obscor(2,i)
267          dn=(x*del(4)+y*del(5)+1.0)
268          xt=(x*del(1)+y*del(2)+del(3))/dn-calc(1,i)
269          yt=(x*del(6)+y*del(7)+del(8))/dn-calc(2,i)
270          write (out,64) i,xt,yt
271          write (*,64) i,xt,yt
272          rmsx=rmsx+xt*xt
273          rmsy=rmsy+yt*yt
274      enddo
275      rmsx=dsqrt(rmsx/4)
276      rmsy=dsqrt(rmsy/4)
277      write (*,'('' rms= '',2f7.3/)'')rmsx, rmsy
278      write (out, 68)rmsx, rmsy, rmsx3, rmsy3, del
279  68      format(/23x,'Rms',2f15.3/23x,'Rms(check)',f8.3, f15.3/
280                  .               /25x,'Transformation Parameters Are:'/13x,2f11.6,f11.4,
281                  .                           2f11.6/13x,2f11.6,f11.4)
282      call NEWPAG
283      write (out,70)ipho
```

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```
284 70  format (//24x,'Plate Coordinates for Frame ',i4//18x,'ID',11x,
285      .           'Measured',13x,'Adjusted'/30x,'X',9x,'Y',10x,'X',9x,'Y')
286      write (out,*)'      Control:'
287      pause
288  c
289  c*****
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

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Source file Listing

```
290  c  Digitize the control points for this photo
291      icon=1
292  100  write(*,*) 'Enter: ',icont(icon)
293      read (dig) data
294      write (*,*) char(7)
295  c
296  c  DECODE data from CHARACTER to INTEGER
297      if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
298      read (data, 50) ibutt,ix,iy
299  c
300  c  Interpret action to take based on which button was pressed:
301      if (ibutt == 4) then
302          write (*,*) 'Abort requested. Restart photo.'
303          write (*,*) char(7),char(7)
304          write (out,*) 'Abort requested*****'
305          write (img,*) 'Abort requested*****'
306          go to 1
307      elseif (ibutt == 3) then
308          xy(1,icon)=ix*units
309          xy(2,icon)=iy*units
310          icon=icon+1
311      elseif (ibutt == 2) then
312          icon=icon-1
313          write (*,*) 'Backing up one to ',icont(icon)
314          write (*,*) char(7),char(7)
315      elseif (ibutt == 1) then
316          xy(1,icon)=-1.
317          xy(2,icon)=-1.
318          write (*,*) '      missing ',icont(icon)
319          write (*,*) char(7)
320          icon=icon+1
321      else
322          write (*,*) 'Not an option. Redo'
323      endif
324      if (icon <= ncont) go to 100
325  c
326      icon=0
327      do k=1,ncont      ! process control points
328          icon=icon+1
329  110      if (icon>ncont) go to 150
330          if (xy(1,icon)<=0) then
331              icon=icon+1
332              go to 110
333          endif
334          x=xy(1,icon)
335          y=xy(2,icon)
336  c  Correct Measured Coordinates for Film Shrinkage & Offset
337          dn=(x*del(4)+y*del(5)+1.0)
338          xt=(x*del(1)+y*del(2)+del(3))/dn-xo(1,icam)
339          yt=(x*del(6)+y*del(7)+del(8))/dn-xo(2,icam)
340  c  Correct for Radial Lens Distortion:
341          rt2=(xt**2+yt**2)
```

Anthropometry and Initial Conditions Photogrammetric Program

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SUBROUTINE HEADS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

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Source file Listing

```
342      rt4=rt2*rt2
343      rt6=rt4*rt2
344      c1=fk(2,icam)*rt2+fk(3,icam)*rt4+fk(4,icam)*rt6+1.d0+fk(1,icam)
345      xt=c1*xt
346      yt=c1*yt
347  c
348      write (out,112) icont(icon),x,y,xt,yt
349  112      format (14x,a8,2x,2f10.3,1x,2f10.3)
350      write (img,114) icont(icon),xt,yt,ifram(ipho)
351  114      format (a8,2x,2f10.4,15x,'Photo ',a8)
352      enddo
353  c
354  150  write (out,*)'      Targets:'
355  pause
356
357 ****
358 c  Digitize the target points for this photo
359      itar=1
360  200  write(*,*) 'Enter: ', itarg(itar+jt)
361      read (dig) data
362      write (*,*) char(7)
363  c
364 c  DECODE data from CHARACTER to INTEGER
365      if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
366      read (data, 50) ibutt,ix,iy
367  c
368 c  Interpret action to take based on which button was pressed:
369      if (ibutt == 4) then
370          write (*,*) 'Abort requested. Restart photo.'
371          write (*,*) char(7),char(7)
372          write (out,*) 'Abort requested*****'
373          write (img,*) 'Abort requested*****'
374          go to 1
375      elseif (ibutt == 3) then
376          xy(1,itar)=ix*units
377          xy(2,itar)=iy*units
378          itar=itar+1
379      elseif (ibutt == 2) then
380          itar=itar-1
381          write (*,*) 'Backing up one to ',itarg(itar+jt)
382          write (*,*) char(7),char(7)
383      elseif (ibutt == 1) then
384          xy(1,itar)=-1.
385          xy(2,itar)=-1.
386          write (*,*) '      missing ', itarg(itar+jt)
387          write (*,*) char(7)
388          itar=itar+1
389      else
390          write (*,*) 'Not an option. Redo'
391      endif
392      if (itar <= ntarg) go to 200
393  c
394      itar=0
```

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 SUBROUTINE HEADS Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

395      do k=1,ntarg      ! process target points
396          itar=itar+1
397      210      if (itar>ntarg) go to 250
398          if (xy(1,itar)<=0) then
399              itar=itar+1
400              go to 210
401          endif
402          x=xy(1,itar)
403          y=xy(2,itar)
404      c  Correct Measured Coordinates for Film Shrinkage & Offset
405          dn=(x*del(4)+y*del(5)+1.0)
406          xt=(x*del(1)+y*del(2)+del(3))/dn-xo(1,icam)
407          yt=(x*del(6)+y*del(7)+del(8))/dn-xo(2,icam)
408      c  Correct for Radial Lens Distortion:
409          rt2=(xt**2+yt**2)
410          rt4=rt2*rt2
411          rt6=rt4*rt2
412          c1=fk(2,icam)*rt2+fk(3,icam)*rt4+fk(4,icam)*rt6+1.d0+fk(1,icam)
413          xt=c1*xt
414          yt=c1*yt
415      c
416          write (out,112) itarg(itar+jt),x,y,xt,yt
417          write (img,114) itarg(itar+jt),xt,yt,ifram(ipho)
418      enddo
419      c
420      250      write (img,'(A8)') '*****'
421      c
422      go to 1
423      c
424      999      write (out,*)char(12)
425      END

```

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 SUBROUTINE BODY Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

426      c
427      SUBROUTINE BODY
428      c          XRay Digitization Of Body Anthropometry
429          implicit real*8 (a-h,o-z)
430          common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
431          common /titlep/ title, page, out, img, dig
432          character*74 title
433          integer page, out, img, dig
434          character data*17
435          character*8 ifram(4),idbod(16), idpt
436          integer ibutt, ifid, ix, iy, idfd(10)
437          real*8 xy(2,21), calfid(2,10,2)
438          logical iflag
439          data ifram /'LfEyLfSh','RtEyLfSh', 'LfEyRtSh','RtEyRtSh'/
440          data idbod /'Origin','Rib_Lf','Rib_Rt','SpineTop','SpineBot',
441          .          'spine_bb','sternum', 'lf_shold','rt_shold',
442          .          'ltp','rtp','ctp','lneckT','lneckB','rneckT','rneckB'/
443          data calfid/-190.190,-147.150, -77.030,-160.380, 77.220,-158.830,
444          .          192.510,-146.442,-190.060, 5.760, 191.570, 5.990,
445          .          -190.490, 157.980, -75.380, 146.070, 77.730, 147.920,
446          .          191.520, 158.540,-193.950,-148.160, -80.380,-162.380,
447          .          75.670,-164.310, 191.214,-148.961,-193.920, 5.010,
448          .          192.310, 4.800,-193.010, 159.210, -80.050, 147.600,

```

Anthropometry and Initial Conditions Photogrammetric Program

```
449      .          75.390, 144.880, 192.720, 158.520/
450  c
451  c  Read order of transformation
452  write (*,*) ' Enter number of parameters for shrinkage fit: '
453  read (*,*) iopt1
454  write (*,*) 
455  if (iopt1>6)iopt1=8
456  ich3s=0
457  if (iopt1<=3) then
458    ich3s=1
459    iopt1=3
460  end if
461  nbod=16
462  units=.0254d0
463  sdx = 1.0d0
464  sdy = 1.0d0
465  c
466  1  write (*,*) ' Enter 0 when finished'
467  write (*,*) ' Enter 1 if: Left Eye View---Left Shoulder to Plate'
468  write (*,*) ' Enter 2 if: Right Eye View---Left Shoulder to Plate'
469  write (*,*) ' Enter 3 if: Left Eye View--Right Shoulder to Plate'
470  write (*,*) ' Enter 4 if: Right Eye View--Right Shoulder to Plate'
471  write (*,*) 
472  read (*,*) ians
473  if(ians==0) go to 999
474  c
475  call CLEAR
476  c
477  focal= -889.0d0
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

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Source file Listing

```
478  call NEWPAG
479  write (out,2400)ifram(ians)
480  c
481  c  Write Calibrated Fiducial Coordinates
482  c
483  jfid=2
484  do ifid=1, 10
485    write (out,2420) ifid,calfid(1,ifid,jfid),calfid(2,ifid,jfid)
486  enddo
487  c
488  c  Read & Write Frame ID
489  c
490  write (img,1516) ifram(ians), focal, sdx, sdy
491  call NEWPAG
492  write (out,2380) ifram(ians)
493 ****
494  c  Start major loop for digitizing x-rays:
495  iflag=.true.
496  IFID=1
497  10  read (dig) DATA
498  write (*,*) CHAR(7)
499  c
500  c  DECODE data from CHARACTER to INTEGER
501  c
502  if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
503  read (DATA, 20) IBUTT,IX,IY
504  20  FORMAT (I1,1X,I6,1X,I6)
505  c
506  c  Interpret action to take based on which button was pressed:
507  if (ibutt == 3) then
```

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```

508      xy(1,ifid)=ix*units
509      xy(2,ifid)=iy*units
510      write (*,30) ' FIDUCIAL',ifid,xy(1,ifid),xy(2,ifid)
511 30      format (a,1x,i3,2x,f8.4,2x,f8.4)
512      if(iflag)then
513          isavex=ix
514          isavey=iy
515          iflag=.false.
516      endif
517      ifid=ifid+1
518      elseif (ibutt == 2) then
519          ifid=ifid-1
520          write (*,*) 'Backing up one to FIDUCIAL # ',ifid
521          write (*,*) char(7),char(7)
522      elseif (ibutt == 1) then
523          xy(1,ifid)=-1.
524          xy(2,ifid)=-1.
525          write (*,*) '      MISSING ', ifid
526          ifid=ifid+1
527      else
528          write (*,*) 'Not an option. Redo'
529      endif

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 SUBROUTINE BODY Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

530      if (ifid <= 10) go to 10
531  c
532      ifid=0
533      do k=1,10
534  c
535  c  Store observed (digitized) coordinates
536  c
537      ifid=ifid+1
538  80      if (ifid>10) go to 210
539      if (xy(1,ifid)<=0) then
540          ifid=ifid+1
541          go to 80
542      endif
543      kk=ifid
544      do i=1,2
545          obscor(i,ifid)=xy(i,ifid)
546          calcor(i,ifid)=calfid(i,kk,jfid)
547      enddo
548      idfd(k)=kk
549      write (out,64) kk,xy(1,ifid),xy(2,ifid)
550  64      format (22x,i4,2f15.3)
551      enddo
552  c
553  c  Compute the 3-Parameter Check Transformation.
554  c
555  210  nfid=k-1
556  ich3=1
557  call FOURP
558  write (*,*) ' 3-Parameter Check Transformation'
559  rmsx=0.
560  rmsy=0.
561  do i=1,nfid
562      x=obscor(1,i)
563      y=obscor(2,i)
564      den=(x*del(4)+y*del(5)+1.0)
565      xt=(x*del(1)+y*del(2)+del(3))/den-calc

```

Anthropometry and Initial Conditions Photogrammetric Program

```
566      yt=(x*del(6)+y*del(7)+del(8))/den-calcor(2,i)
567      kk=idfd(i)
568      write ( *,2560) kk,xt,yt
569      rmsx=rmsx+xt*xt
570      rmsy=rmsy+yt*yt
571      enddo
572      rmsx3=dsqrt(rmsx/nfid)
573      rmsy3=dsqrt(rmsy/nfid)
574      write (*,230) rmsx, rmsy
575      230 format (' rms= ',2f7.3)
576      write (*,*)
577      write (*,*)iopt1,'-Parameter Transformation'
578      rmsx=0.
579      rmsy=0.
580  c
581  c  Compute the Multi-Parameter Transformation.
582      ich3=ich3s
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
583      if (iopt1<=5) call FOURP
584      if (iopt1==5) call FIVEP
585      if (iopt1==6) call SIXP
586      if (iopt1==8) call EIGHTP
587      write (out,2550) iopt1
588  c
589  c  Compute Residuals For the Fiducial Coordinates
590  c
591      do i=1,nfid
592          x=obscor(1,i)
593          y=obscor(2,i)
594          dn=(x*del(4)+y*del(5)+1.0)
595          xt=(x*del(1)+y*del(2)+del(3))/dn-calcor(1,i)
596          yt=(x*del(6)+y*del(7)+del(8))/dn-calcor(2,i)
597          kk=idfd(i)
598          write (out,2560) kk,xt,yt
599          write ( *,2560) kk,xt,yt
600          rmsx=rmsx+xt*xt
601          rmsy=rmsy+yt*yt
602      enddo
603      rmsx=dsqrt(rmsx/nfid)
604      rmsy=dsqrt(rmsy/nfid)
605      write (*,230) rmsx, rmsy
606      write(out, 2545) rmsx, rmsy, rmsx3, rmsy3, del
607      2545 format(23x,'Rms',2f15.3/23x,'Rms(check)',f8.3, f15.3/
608      .           /25x,'Transformation Parameters Are: /13x,2f11.6,f11.4,
609      .           2f11.6/13x,2f11.6,f11.4)
610      call NEWPAG
611      write (out,2575)ifram(ians)
612      pause
613  ****
614      500  ibod=1
615      550  read (dig) data
616      write (*,*) CHAR(7)
617  c
618  c  DECODE data from CHARACTER to INTEGER
619  c
620      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
621      read (data, 20) ibutt,ix,iy
622  c
623  c  Interpret action to take based on which button was pressed:
```

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```

624      if (ibutt == 4) then
625          write (*,*) 'Abort requested. Restart photo.'
626          write (*,*) char(7),char(7)
627          write (out,*) 'Abort requested*****'
628          write (img,*) 'Abort requested*****'
629          go to 1
630      elseif (ibutt == 3) then
631          xy(1,ibod)=IX*units
632          xy(2,ibod)=IY*units
633          write (*,555) idbod(ibod),xy(1,ibod),xy(2,ibod)
634      555      format (a10,2x,f8.4,2x,f8.4)

```

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 SUBROUTINE BODY Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK /NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

635          ibod=ibod+1
636      elseif (ibutt == 2) then
637          ibod=ibod-1
638          write (*,*) 'Backing up one to ', idbod(ibod)
639          WRITE (*,*) char(7),char(7)
640      elseif (ibutt == 1) then
641          xy(1,ibod)=-1.
642          xy(2,ibod)=-1.
643          write (*,*) 'MISSING ', idbod(ibod)
644          ibod=ibod+1
645      else
646          write (*,*) 'Not an option. Redo'
647      endif
648      if (ibod <= nbod) go to 550
649  c
650      ibod=0
651      do 690 k=1,nbod
652  c
653  c Process measured body coordinates
654  c
655          ibod=ibod+1
656      590      if (ibod>nbod) go to 700
657          if (xy(1,ibod)<=0) then
658              ibod=ibod+1
659              go to 590
660          endif
661          kk=ibod
662          x=xy(1,ibod)
663          y=xy(2,ibod)
664          idpt=idbod(ibod)
665  c
666  c Correct Measured Coordinates for Film Shrinkage
667  c
668          xt=(x*del(1)+y*del(2)+del(3))/(x*del(4)+y*del(5)+1.0)
669          yt=(x*del(6)+y*del(7)+del(8))/(x*del(4)+y*del(5)+1.0)
670  c
671          write (out,2605) idpt,x,y,xt,yt
672  c
673  c Write Records for Triangulation Input to file: "img.dat"
674          write (img,1610) idpt,xt,yt,ifram(ians)
675      690  continue
676  c
677      700  icode=0
678      710  write (*,*) ' Re-do first fiducial'
679          read (dig) data
680          write (*,*) char(7)
681  c
682  c DECODE data from CHARACTER to INTEGER

```

Anthropometry and Initial Conditions Photogrammetric Program

```
683 c
684     if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
685     read (data, 20) ibutt,ix,iy
686     if(iabs(ix-isavex)+iabs(iy-isavey) > 3*(rmsx+rmsy)/units)then
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
687         write (*,*)' You blew it', ix, iy, ' vs.', isavex, isavey
688         write (*,*) char(7)
689         write (*,*) char(7)
690         ict=ict+1
691         if(ict<=4) go to 710
692         write(*, *)'No more tries...origin lost...going back to menu'
693         write (img,'(a8)') '*****'
694         go to 1
695     endif
696     pause
697     write (img,'(a8)') '*****'
698     go to 1
699 c
700 999 call CLEAR
701     write (out,*)char(12)
702 c
703 1370 format (2i1,8x,3f10.3)
704 1410 format (2x,i4,4x,2f10.4)
705 1440 format (2d20.10)
706 1445 format (3d20.10)
707 1450 format (//42x,sp,'CALIBRATED FOCAL LENGTH = ',f9.3,' mm.')
708 1460 format (//51x,sp,'LENS DISTORTION'//51x,'RADIAL PARAMETERS'/31x
709     . 'K0='d15.8d2,' K1='d15.8d2,' K2='d15.8d2/51x'K3='d15.8d2
710     . '://:45x,'LENS DECENTRATION PARAMETERS'/31x,'J1= 'd15.8d2,
711     . ' J2= 'd15.8d2,' PHI= 'd15.8d2/)
712 c
713 1470 format (i2)
714 1480 format (2f10.3)
715 1485 format (8x,'Calibrated Focal Length (CFL) in millimeters = ')
716 1500 format (44x,2f13.3)
717 1510 format (6x,i4,6f10.3)
718 1516 format (a8,2x,sp,f10.3:,ss,2(f10.3),10x)
719 1580 format (2x,a8,6f10.3)
720 1605 format (34x,a8,2x,2f10.3,1x,2f10.3)
721 1610 format (a8,2x,2f10.4,15x,'Photo ',a8)
722 c
723 2380 format (20x,'Fiducial Measurements of Frame ',a8// 24x,'ID',12x,
724     . 'Measured'/37x,'X',14x,'Y')
725 2400 format (16x,'Calibrated Fiducial Coordinates of Frame ',a8// 
726     . 26x, 'Fid', 9x, 'X', 12x, 'Y')
727 2420 format (25x,i4,5x,f8.3,5x,f8.3)
728 2450 format (//25x,sp,'Calibrated Focal Length = ',f9.3,' mm.')
729 2460 format (//31x,sp,'Lens Distortion'//31x,'Radial Parameters'/11x
730     . 'K0='d15.8d2,' K1='d15.8d2,' K2='d15.8d2/31x'K3='d15.8d2
731     . '://:25x,'Lens Decentration Parameters'/11x,'J1= 'd15.8d2,
732     . ' J2= 'd15.8d2,' PHI= 'd15.8d2/)
733 2500 format (24x,2f13.3)
734 2550 format (//i18,'-Parameter Residuals of the Fiducial Coordinates'//
735     . 23x, 'Fid', 11x, 'X', 14x, 'Y')
736 2560 format (22x,i4,2f15.3)
737 2570 format (//22x,'Plate Coordinates for Frame ',a8//      ID',11x,
738     . 'Measured',13x,'Adjusted',13x,'Max Spread',11x,'Frame'/
739     . 17x,'X',9x,'Y',10x,'X',9x,'Y',10x,'X',9x,'Y')
```

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SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
740 2575 format (//22x,'Plate Coordinates for Frame ',a8//18x,'ID',11x,  
741 . 'Measured',13x,'Adjusted'/30x,'X',9x,'Y',10x,'X',9x,'Y')  
742 2600 format (x,a8,2x,2f10.3,1x,2f10.3,1x,2f10.3)  
743 2605 format (14x,a8,2x,2f10.3,1x,2f10.3)  
744 end
```

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SUBROUTINE FID Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
745 c-----  
746      SUBROUTINE FID(Z)  
747 c  Intersects the edge lines (formed by a least squares on 3 points)  
748 c  to give the corner fiducials. Stores output back in the input array.  
749      implicit real*8 (a-d, x-z)  
750      real*8 z(2,12), x(3), y(3)  
751      n=3  
752 c  left  
753      x1=0.  
754      y1=0.  
755      y2=0.  
756      xy=0.  
757      do i=1, 3  
758          x(i)=z(1,9+i)      ! 10, 11, 12  
759          y(i)=z(2,9+i)  
760          x1=x1+x(i)  
761          y1=y1+y(i)  
762          y2=y2+y(i)*y(i)  
763          xy=xy+x(i)*y(i)  
764      enddo  
765      den=n*y2-y1*x1  
766      c= ( n*xy-y1*x1)/den  
767      d=-(y1*xy-x1*y2)/den  
768 c  top  
769      x1=0.  
770      y1=0.  
771      x2=0.  
772      xy=0.  
773      do i=1, 3  
774          x(i)=z(1,i)      ! 1, 2, 3  
775          y(i)=z(2,i)  
776          x1=x1+x(i)  
777          y1=y1+y(i)  
778          x2=x2+x(i)*x(i)  
779          xy=xy+x(i)*y(i)  
780      enddo  
781      den=n*x2-x1*x1  
782      a= ( n*xy-y1*x1)/den  
783      b=-(x1*xy-y1*x2)/den  
784 c  
785      z(1,3)=(b*c+d)/(1-a*c)      ! upper left = 3rd  
786      z(2,3)=(a*d+b)/(1-a*c)  
787 c  
788      cx=c  
789      dx=d  
790 c  right  
791      x1=0.
```

Anthropometry and Initial Conditions Photogrammetric Program

```
792      y1=0.  
793      y2=0.  
794      xy=0.  
795      do i=1, 3  
796          x(i)=z(1,3+i)      ! 4, 5, 6
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE FID Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
797      y(i)=z(2,3+i)  
798      x1=x1+x(i)  
799      y1=y1+y(i)  
800      y2=y2+y(i)*y(i)  
801      xy=xy+x(i)*y(i)  
802      enddo  
803      den=n*y2-y1*y1  
804      c= ( n*xy-y1*x1)/den  
805      d=-(y1*xy-x1*y2)/den  
806  c  
807      z(1,2)=(b*c+d)/(1-a*c)      ! upper right = 2nd  
808      z(2,2)=(a*d+b)/(1-a*c)  
809  c  bottom  
810      x1=0.  
811      y1=0.  
812      x2=0.  
813      xy=0.  
814      do i=1, 3  
815          x(i)=z(1,6+i)      ! 7, 8, 9  
816          y(i)=z(2,6+i)  
817          x1=x1+x(i)  
818          y1=y1+y(i)  
819          x2=x2+x(i)*x(i)  
820          xy=xy+x(i)*y(i)  
821      enddo  
822      den=n*x2-x1*x1  
823      a= ( n*xy-y1*x1)/den  
824      b=-(x1*xy-y1*x2)/den  
825  c  
826      z(1,1)=(b*c+d)/(1-a*c)      ! lower right = 1st  
827      z(2,1)=(a*d+b)/(1-a*c)  
828  c  
829      z(1,4)=(b*cx+dx)/(1-a*cx)      ! lower left = 4th  
830      z(2,4)=(a*dx+b)/(1-a*cx)  
831      end
```

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SUBROUTINE FOURP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
832  c-----  
833      SUBROUTINE FOURP  
834  c  
835  c  Calculate the 3 or 4 Parameter Transformation Between an Exact Set  
836  c      of Data and a Corresponding Set of Measured Data.  
837  c  
838      implicit real*8 (a-h,o-z)  
839      intrinsic dsqrt  
840      dimension am(2,4), cm(2)  
841      common calcor(2,50), obscor(2,50), eqn(8,9), del(8), ich3, nfid
```

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```

842 c
843     do i=1,4
844         do j=1,5
845             eqn(i,j)=0.0d0
846         enddo
847     enddo
848     am(1,3)=1.0d0
849     am(1,4)=0.0d0
850     am(2,3)=0.0d0
851     am(2,4)=1.0d0
852     do i=1,nfid
853         am(1,1)=obscor(1,i)
854         am(1,2)=obscor(2,i)
855         am(2,1)=am(1,2)
856         am(2,2)=-am(1,1)
857         cm(1)=calcor(1,i)
858         cm(2)=calcor(2,i)
859         do j=1,4
860             do k=1,2
861                 eqn(j,5)=eqn(j,5)+am(k,j)*cm(k)
862                 do l=1,4
863                     eqn(j,l)=eqn(j,l)+am(k,j)*am(k,l)
864                 enddo
865             enddo
866         enddo
867     enddo
868     call LINSOL(4)
869     if (ich3==0) go to 1060
870 c
871 c If ich3<>0 Transform the 4-param to a 3-param
872 c
873     scale=eqn(1,5)**2+eqn(2,5)**2
874     scale=dsqrt(scale)
875     eqn(1,5)=eqn(1,5)/scale
876     eqn(2,5)=eqn(2,5)/scale
877     sum1=0.0d0
878     sum2=0.0d0
879     do i=1,nfid
880         x=obscor(1,i)
881         y=obscor(2,i)
882         sum1=sum1+calcor(1,i)-eqn(1,5)*x-eqn(2,5)*y
883         sum2=sum2+calcor(2,i)+eqn(2,5)*x-eqn(1,5)*y

```

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 SUBROUTINE FOURP Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

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```

884     enddo
885     eqn(3,5)=sum1/nfid
886     eqn(4,5)=sum2/nfid
887 c
888 c Form Transformation parameters vector
889 c
890 1060 del(1)=eqn(1,5)
891     del(2)=eqn(2,5)
892     del(3)=eqn(3,5)
893     del(4)=0.0d0
894     del(5)=0.0d0
895     del(6)=-del(2)
896     del(7)=del(1)
897     del(8)=eqn(4,5)
898 end

```

Anthropometry and Initial Conditions Photogrammetric Program

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SUBROUTINE FIVEP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
899 c-----  
900      SUBROUTINE FIVEP  
901 c  
902 c Calculate the FIVE Parameter Transformation Between an Exact Set  
903 c      of Data and a Corresponding Set of Measured Data.  
904 c  
905      implicit real*8 (a-h,o-z)  
906      intrinsic dsin, dcos, dabs  
907      dimension b(2,5),c(2),cv(5),par(5)  
908      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid  
909 c  
910      par(1)=dsqrt(del(1)**2+del(2)**2)  
911      par(2)=par(1)  
912      par(3)=datan2(del(2),del(1))  
913      par(4)=del(3)  
914      par(5)=del(8)  
915      b(1,2)=0.0d0  
916      b(1,5)=0.0d0  
917      b(2,1)=0.0d0  
918      b(2,4)=0.0d0  
919      do 30 ii=1,10  
920          do i=1, 5  
921              cv(i)=0.0d0  
922              do j=1, 5  
923                  eqn(i, j)=0.0d0  
924                  enddo  
925          enddo  
926          do i=1,nfid  
927              b(1,4)=par(1)  
928              b(2,5)=par(2)  
929              sint=dsin(par(3))  
930              cost=dcos(par(3))  
931              x=obscor(1,i)  
932              y=obscor(2,i)  
933              c1=-x*sint+y*cost  
934              c2= x*cost+y*sint  
935              b(1,1)=c2*par(1)  
936              b(1,3)=c1*par(1)**2  
937              b(2,2)=c1*par(2)  
938              b(2,3)=-c2*par(2)**2  
939              c(1)=par(1)*(calcor(1,i)-par(1)*c2-par(4))  
940              c(2)=par(2)*(calcor(2,i)-par(2)*c1-par(5))  
941          do j=1,5  
942              do k=1,2  
943                  cv(j)=cv(j)+b(k,j)*c(k)  
944                  do l=1,5  
945                      eqn(j,l)=eqn(j,l)+b(k,j)*b(k,l)  
946                  enddo  
947              enddo  
948          enddo  
949      enddo  
950 c  
951 c      Solve normal equations
```

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SUBROUTINE FIVEP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
952 c
953      call LINSOL(5)
954      do j=1, 5
955          par(j)=par(j)+eqn(j, 6)
956      enddo
957 c
958 c  Test for convergence
959 c
960      do 20 j=1, 5
961          c1=dabs(eqn(j, 6))
962          epsln=1.0d-6
963          if(j>3)epsln=1.0d-4
964          if(c1>epsln)go to 30
965 20      continue
966      go to 40
967 30      continue
968      call CLEAR
969      write (*,*) char(7)
970      write (*,*)' Error in FIVEP'
971      stop
972 c
973 c  Form transformation parameters vector
974 c
975 40      sint=dsin(par(3))
976      cost=dcos(par(3))
977      del(1)=par(1)*cost
978      del(2)=par(1)*sint
979      del(3)=par(4)
980      del(4)=0.0d0
981      del(5)=0.0d0
982      del(6)=-par(2)*sint
983      del(7)=par(2)*cost
984      del(8)=par(5)
985      end
```

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SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
986 c-----
987      SUBROUTINE SIXP
988 c
989 c  Calculate the SIX Parameter Transformation Between an Exact Set
990 c      of Data and a Corresponding Set of Measured Data.
991 c
992      implicit real*8 (a-h,o-z)
993      dimension ans(2,3), ccc(3,3), ddd(3,2), rrr(2,2), err(2)
994      common calcor(2,50), obscor(2,50), eqn(8,9), del(8), ich3, nfid
995 c
996 c  Zero Normal Equation Area.
997 c
998      do i=1,2
999          do j=1,3
1000              ccc(i,j)=0.0d0
1001              ddd(j,i)=0.0d0
1002          enddo
1003      enddo
```

Anthropometry and Initial Conditions Photogrammetric Program

```
1004 c
1005 c Compute Normal Equations
1006 c
1007     do i=1,nfid
1008         do j=1,2
1009             ccc(j,3)=ccc(j,3)+calcor(j,i)
1010             ddd(3,j)=ddd(3,j)+obscor(j,i)
1011             do k=1,2
1012                 ccc(j,k)=ccc(j,k)+calcor(j,i)*calcor(k,i)
1013                 ddd(j,k)=ddd(j,k)+calcor(j,i)*obscor(k,i)
1014             enddo
1015         enddo
1016     enddo
1017     ccc(3,1)=ccc(1,3)
1018     ccc(3,2)=ccc(2,3)
1019     ccc(3,3)=nfid
1020 c
1021 c Compute Inverse of Normal Matrix.
1022 c
1023     iggy=3
1024     call INVERT (CCC,IGGY,DET)
1025 c
1026 c Compute the Transformation Parameters
1027 c
1028     do i=1,2
1029         do j=1,3
1030             ans(i,j)=0.0d0
1031             do k=1,3
1032                 ans(i,j)=ans(i,j)+ccc(j,k)*ddd(k,i)
1033             enddo
1034         enddo
1035     enddo
1036 c
1037 c Calculate the Transformation from Measured Data to Exact Data.
1038 c
```

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SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1039     do i=1,2
1040         do j=1,2
1041             rrr(i,j)=ans(i,j)
1042         enddo
1043     enddo
1044     iggy=2
1045     call INVERT (RRR,IGGY,DET)
1046     do i=1,2
1047         do j=1,2
1048             ans(i,j)=rrr(i,j)
1049         enddo
1050     enddo
1051     do i=1,2
1052         err(i)=-ans(i,1)*ans(1,3)-ans(i,2)*ans(2,3)
1053     enddo
1054     do i=1,2
1055         ans(i,3)=err(i)
1056     enddo
1057 c
1058 c Form transformation parameters vector
1059 c
1060     del(1)=ans(1,1)
1061     del(2)=ans(1,2)
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```
1062      del(3)=ans(1,3)
1063      del(4)=0.0d0
1064      del(5)=0.0d0
1065      del(6)=ans(2,1)
1066      del(7)=ans(2,2)
1067      del(8)=ans(2,3)
1068      end
```

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SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1069  c -----
1070      SUBROUTINE EIGHTP
1071  c
1072  c Calculate the EIGHT Parameter Transformation Between an Exact Set
1073  c      of Data and a Corresponding Set of Measured Data.
1074  c
1075      implicit real*8 (a-h,o-z)
1076      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1077      real*8      tem(8)
1078  c
1079  c Zero the matrix of linear equations EQN
1080  c
1081      do i=1,8
1082          del(i)=0.0d0
1083          do j=1,9
1084              eqn(i,j)=0.0d0
1085          enddo
1086      enddo
1087  c
1088  c Compute approximate values for the transformation parameters
1089  c
1090      do i=1,nfid
1091          call ACCAPR (calcor(1,i),calcor(2,i),obscor(1,i),obscor(2,i))
1092      enddo
1093      n=8
1094      call INVERT (eqn, n, d)
1095      do i=1, 8
1096          do j=1, 8
1097              del(i)=del(i)+eqn(i, j)*eqn(j, 9)
1098          enddo
1099      enddo
1100  c
1101  c Compute the transformation parameters by least squares
1102  c
1103      do 50 m=1,5
1104  c
1105  c Zero the normal equations
1106  c
1107      do i=1,8
1108          tem(i)=0.0d0
1109          do j=1,9
1110              eqn(i,j)=0.0d0
1111          enddo
1112      enddo
1113  c
1114  c Form the normal equations
1115  c
1116      do i=1,nfid
1117          call ACCNEQ(calcor(1,i),calcor(2,i),obscor(1,i),obscor(2,i))
1118      enddo
1119  c
```

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```
1120 c Solve the normal equations
1121 c
```

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SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1122      call INVERT(eqn, n, d)
1123      do i=1, 8
1124          do j=1, 8
1125              tem(i)=tem(i)+eqn(i, j)*eqn(j, 9)
1126          enddo
1127      enddo
1128 c
1129 c Correct the approximate values of the transformation parameters
1130 c
1131     do i=1, 8
1132         del(i)=del(i)+tem(i)
1133     enddo
1134 c
1135 c Test the solution for convergence
1136 c
1137     do i=1, 8
1138         d=dabs(del(i)/(del(i)-tem(i))-1.0)
1139         if (d>.001d0) go to 50
1140     enddo
1141     return
1142 50  continue
1143 end
```

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SUBROUTINE LINSOL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1144 c-----
1145      SUBROUTINE LINSOL(NPAR)
1146 c
1147 c Solution of (NPAR) linear equations in (NPAR) unknowns.
1148 c
1149     implicit real*8 (a-h,o-z)
1150     common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1151 c
1152     do 1040 k=1,npar
1153         m=npar+1
1154         do j=k,npar+1
1155             eqn(k,m)=eqn(k,m)/eqn(k,k)
1156             m=m-1
1157         enddo
1158         do 1030 i=1,npar
1159             if (i==k) go to 1030
1160             m=npar+1
1161             do l=k,npar+1
1162                 eqn(i,m)=eqn(i,m)-eqn(i,k)*eqn(k,m)
1163                 m=m-1
1164             enddo
1165 1030     continue
1166 1040 continue
1167 c
1168 end
```

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SUBROUTINE ACCAPR Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1169 c-----  
1170      SUBROUTINE ACCAPR (XG,YG,XP,YP)  
1171 c  
1172 c Evaluate the contribution of one point to the 8 by 9 matrix of  
1173 c normal equations for computation of approximate values of the  
1174 c eight-parameter film shrinkage transformation.  
1175 c  
1176 c      XG: Calibrated X Fiducial coordinate  
1177 c      YG: Calibrated Y Fiducial coordinate  
1178 c      XP: Observed X Fiducial coordinate  
1179 c      YP: Observed Y Fiducial coordinate  
1180 c      EQN: 8 X 8 Coefficient matrix of the Normal Equation  
1181 c      with the vector of constants in column 9.  
1182 c  
1183      implicit real*8 (a-h,o-z)  
1184      dimension am(2,8), bm(2)  
1185      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid  
1186 c  
1187      am(1,1)=xp  
1188      am(1,2)=yp  
1189      am(1,3)=1.0d0  
1190      am(1,4)=-xg*xp  
1191      am(1,5)=-xg*yp  
1192      am(1,6)=0.0d0  
1193      am(1,7)=0.0d0  
1194      am(1,8)=0.0d0  
1195      am(2,1)=0.0d0  
1196      am(2,2)=0.0d0  
1197      am(2,3)=0.0d0  
1198      am(2,4)=-xp*yg  
1199      am(2,5)=-yp*yg  
1200      am(2,6)=xp  
1201      am(2,7)=yp  
1202      am(2,8)=1.0d0  
1203      bm(1)=xg  
1204      bm(2)=yg  
1205      do i=1,8  
1206          do j=1,8  
1207              do k=1,2  
1208                  eqn(i,j)=eqn(i,j)+am(k,i)*am(k,j)  
1209              enddo  
1210          enddo  
1211      enddo  
1212      do i=1,8  
1213          do j=1,2  
1214              eqn(i,9)=eqn(i,9)+am(j,i)*bm(j)  
1215          enddo  
1216      enddo  
1217  end
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE ACCNEQ Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1218 c-----  
1219      SUBROUTINE ACCNEQ (XG,YG,XP,YP)  
1220 c
```

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Anthropometry and Initial Conditions Photogrammetric Program

```
1221 c Evaluate the contribution of one point to the normal equation
1222 c required for Subroutine EIGHT. The normal equations are
1223 c required to compute corrections to the last estimate of the
1224 c eight transformation parameters. This is called once for each
1225 c point.
1226 c
1227 c           XG: Calibrated X Fiducial coordinate
1228 c           YG: Calibrated Y Fiducial coordinate
1229 c           XP: Observed X Fiducial coordinate
1230 c           YP: Observed Y Fiducial coordinate
1231 c           EQN: 8 X 8 Coefficient matrix of the Normal Equation
1232 c           with the vector of constants in column 9.
1233 c
1234 c
1235      implicit real*8 (a-h,o-z)
1236      dimension am(2,2), bm(2,8), cm(2), amm(2,2)
1237      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1238 c
1239      am(1,1)=del(1)-xg*del(4)
1240      am(1,2)=del(2)-xg*del(5)
1241      am(2,1)=del(6)-yg*del(4)
1242      am(2,2)=del(7)-yg*del(5)
1243      bm(1,1)=xp
1244      bm(1,2)=yp
1245      bm(1,3)=1.0d0
1246      bm(1,4)=-xp*xg
1247      bm(1,5)=-yp*xg
1248      bm(1,6)=0.0d0
1249      bm(1,7)=0.0d0
1250      bm(1,8)=0.0d0
1251      bm(2,1)=0.0d0
1252      bm(2,2)=0.0d0
1253      bm(2,3)=0.0d0
1254      bm(2,4)=-xp*yg
1255      bm(2,5)=-yp*yg
1256      bm(2,6)=xp
1257      bm(2,7)=yp
1258      bm(2,8)=1.0d0
1259      cm(1)=xp*am(1,1)+yp*am(1,2)+del(3)-xg
1260      cm(2)=xp*am(2,1)+yp*am(2,2)+del(8)-yg
1261 c
1262 c Form modified covariance matrix AMM
1263 c
1264      do i=1,2
1265          do j=1,2
1266              amm(i,j)=0.0d0
1267              do k=1,2
1268                  amm(i,j)=amm(i,j)+am(i,k)*am(j,k)
1269      enddo
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE ACCNEQ Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1270      enddo
1271      enddo
1272      d=amm(1,1)*amm(2,2)-amm(1,2)*amm(2,1)
1273      am(1,1)= amm(2,2)/d
1274      am(2,2)= amm(1,1)/d
1275      am(1,2)=-amm(2,1)/d
1276      am(2,1)= amm(1,2)
1277 c
1278 c Form normal equations
```

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```
1279 c
1280      do i=1,8
1281          do j=1,8
1282              do k=1,2
1283                  do l=1,2
1284                      eqn(i,j)=eqn(i,j)+bm(k,i)*am(k,l)*bm(l,j)
1285                  enddo
1286              enddo
1287          enddo
1288      enddo
1289      do i=1,8
1290          do k=1,2
1291              do l=1,2
1292                  eqn(i,9)=eqn(i,9)-bm(k,i)*am(k,l)*cm(l)
1293              enddo
1294          enddo
1295      enddo
1296  end
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1297 c-----
1298      SUBROUTINE INVERT (A,N,D)
1299 c
1300 c  Find the Inverse of a Matrix by the Gaussian Elimination Method.
1301 c  A: Array in which the matrix to be inverted is located.
1302 c  The routine will search for the largest non-singular matrix in
1303 c  the array A and invert it & return it in the same locations of A.
1304 c  N: The first dimension of A. It must be a variable in the call list.
1305 c  The rank of largest matrix contained in A will be returned in N.
1306 c  D: The determinant of the largest non-singular matrix in A.
1307 c  L & M: Vectors of dimension N used temporarily.
1308 c
1309 c
1310      implicit real*8 (a-h,o-z)
1311      dimension a(64), l(8), m(8)
1312 c
1313 c  Initiate the continued product of pivots becoming the determinant.
1314 c
1315      d=1.0d0
1316 c
1317 c  Initiate the counter which contains the rank of the matrix.
1318 c
1319      ksave=0
1320 c
1321 c  Start the main elimination loop.
1322 c
1323      do 1090 k=1,n
1324 c
1325 c  Search for the largest element
1326 c
1327      l(k)=k
1328      m(k)=k
1329      kk=k+n*(k-1)
1330      biga=a(kk)
1331      do 1010 i=k,n
1332          do 1010 j=k,n
1333              ij=i+n*(j-1)
1334              if (dabs(biga)>=dabs(a(ij))) go to 1010
1335              biga=a(ij)
1336              l(k)=i
```

Anthropometry and Initial Conditions Photogrammetric Program

```
1337      m(k)=j
1338 1010      continue
1339 c
1340 c Largest element of zero means the largest matrix in A is less than N.
1341 c
1342      if (biga==0) GO TO 1100
1343 c
1344 c Interchange rows
1345 c
1346      j=l(k)
1347      ksave=k
1348      if (l(k)<=k) go to 1030
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1349      do i=1,n
1350          ki=k+n*(i-1)
1351          ji=j+n*(i-1)
1352          tem=a(ki)
1353          a(ki)=a(ji)
1354          a(ji)=tem
1355      enddo
1356 c
1357 c Interchange columns.
1358 c
1359 1030      i=m(k)
1360      if (m(k)<=k) go to 1050
1361      do j=1,n
1362          jk=j+n*(k-1)
1363          ji=j+n*(i-1)
1364          tem=a(jk)
1365          a(jk)=a(ji)
1366          a(ji)=tem
1367      enddo
1368 c
1369 c Divide column by minus pivot
1370 c
1371 1050      do 1060 i=1,n
1372          if (i==k) go to 1060
1373          ik=i+n*(k-1)
1374          a(ik)=a(ik)/(-a(kk))
1375 1060      continue
1376 c
1377 c Reduce matrix
1378 c
1379      do 1070 i=1,n
1380          do 1070 j=1,n
1381          if (i==k.or.j==k) go to 1070
1382          ij=i+n*(j-1)
1383          ik=i+n*(k-1)
1384          kj=k+n*(j-1)
1385          a(ij)=a(ik)*a(kj)+a(ij)
1386 1070      continue
1387 c
1388 c Divide row by pivot
1389 c
1390      do 1080 j=1,n
1391          if (j==k) go to 1080
1392          kj=k+n*(j-1)
1393          a(kj)=a(kj)/a(kk)
1394 1080      continue
```

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```
1395 c
1396 c Continued product of pivots
1397 c
1398     d=d*a(kk)
1399     a(kk)=1.0d0/a(kk)
1400 1090 continue
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1401 c
1402 c Final row and column interchange
1403 c
1404 1100 k=ksave+1
1405 1110 k=k-1
1406     if (k<=0) go to 1150
1407 c
1408 c Restore columns.
1409 c
1410     i=l(k)
1411     if (i<=k) go to 1130
1412     do j=1,n
1413         jk=j+n*(k-1)
1414         ji=j+n*(i-1)
1415         tem=a(jk)
1416         a(jk)=-a(ji)
1417         a(ji)=tem
1418     enddo
1419 c
1420 c Restore rows.
1421 c
1422 1130 j=m(k)
1423     if (j<=k) go to 1110
1424     do i=1,n
1425         ki=k+n*(i-1)
1426         ji=j+n*(i-1)
1427         tem=a(ki)
1428         a(ki)=-a(ji)
1429         a(ji)=tem
1430     enddo
1431     go to 1110
1432 c
1433 c Set the rank of the matrix and return to the calling routine.
1434 c
1435 1150 return
1436 end
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE NEWPAG Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1437 c-----
1438     SUBROUTINE NEWPAG
1439 c
1440     common /titlep/ title, page, out, img, dig
1441     character*74 title
1442     integer page, out, img, dig
1443 c
1444     page=page+1
```

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```
1445      if(page>1)write(out,*) char(12)
1446      write (out,10) page,title
1447 10  format(' Naval BioDynamics Laboratory  PREP',31x,' Page',i3
1448                  /a74/)
1449      end
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
SUBROUTINE CLEAR Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
1450 c-----
1451      SUBROUTINE CLEAR
1452 c  clears the screen and moves the cursor to row 8.
1453      write (*,*) char(27)//'[2J'
1454      write (*,*) char(27)//'[1;1H'
1455      write (*,*) char(27)//'[8B'
1456      end
```

Customized GIANT Program Listings

Main Program

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19
PROGRAM NBDL_GIANT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

Page 1

```
1      PROGRAM NBDL_GIANT
2  C
3  C GENERAL INTEGRATED ANALYTICAL TRIANGULATION (GIANT)
4  C
5      common /titlep/ jtitle, ipage
6      character jtitle*76
7      include 'inc\tapes.inc'
11 1      INTEGER CAMERA,FRAMES,OBJECT
11 2      COMMON /TAPES/ IN,IO,IOS,IOIC, IP1, IP2,
11 3      .           CAMERA,IMAGES,FRAMES,OBJECT,
11 4      .           ITAPE1,ITAPE2,ITAPE3,ITAPE4,
11 5      .           ITAPE5,ITAPE6,ITAPE7,ITAPE0
11 6
8      common /offset/off(2)
9      common /anthr/ians, p(15, 3)
10     real*8 p
11  C
12     character irun*6, fn*12
13     call system('cls')
14     IN=11
15     IO=12
16     IOS=13
17     IP1=14
18     IP2=15
19     CAMERA=IN
20     IMAGES=16
21     FRAMES=IN
22     OBJECT=IN
23     ITAPE1=17
24     ITAPE2=18
25     ITAPE3=19
26     ITAPE4=20
27     ITAPE5=21
28     ITAPE6=22
29     ITAPE7=23
30     ITAPE0=24
31     IOIC=25
32  C
33     write(*,*)' Enter 0 for initial conditions'
34     write(*,*)' Enter 1 for head anthropometry'
35     write(*,*)' Enter 2 for body anthropometry'
36     write(*,*)' Enter 3 for standard giant '
37     read(*,*)ians
38     if (ians==0) then
39         open (in, status='old', file='optcams.dat')
40     elseif (ians==1) then
41         open (in, status='old', file='opthead.dat')
42     elseif (ians==2) then
43         open (in, status='old', file='optxray.dat')
```

Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19
PROGRAM NBDL_GIANT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
44      else
45          open (in, status='old', file='opt.dat')
46      endif
47      if(ians==0)then
48 1      write(*,*)' Enter RUN number (A6): '
49      read (*,*) irun
50      do i=1,6
51          if(irun(i:i)==' ')go to 1
52      enddo
53      write (*,*)'
54      jtitle=' 35mm Still Camera System for Initial Conditions of
55      RUN # = '//irun
56      open (images, status='old', file=irun//'.im.dat')
57      open (unit=io, status='unknown',file=irun//'.132')
58      open (unit=io, status='unknown',file='nul')
59      open (unit=ios,status='unknown',file=irun//'.out')
60      open (unit=ioic,status='unknown',file=irun//'.ic')
61      elseif(ians<3)then
62          write (*,*) ' Enter HRV number: '
63          read (*,*) ihrv
64          write (*,*)
65          if(ians==1)then
66              write (fn,"(i4.4,'himg.dat')")ihrv
67              jtitle=' 35mm Still Camera System for Head Anthropometry of
68              HRV # = '//fn(1:4)
69              open (unit=ios,status='unknown',file=fn(1:4)//'head.out')
70              open (images,status='old',file =fn)
71              read (images, *) off
72              if (dabs(off(1)+off(2)-10)>2) then
73                  write(*,*) 'Offset sum < 8 or > 12. check it out.'
74                  stop
75              endif
76          else
77              write (fn,"(i4.4,'bimg.dat')")ihrv
78              jtitle=' X-Ray Determination of Body Anthropometry of
79              HRV # = '//fn(1:4)
80              open (unit=ios,status='unknown',file=fn(1:4)//'body.out')
81              open (images,status='old',file =fn)
82          endif
83          open (unit=io, status='unknown',file=fn(1:5)//'.132')
84      else
85          write(*,*)' Enter title (A76) '
86          write(*,*)
87          read(*,'(A)')jtitle
88          open (images,status='old',file ='img.dat')
89          open (unit=io, status='unknown',file='giant.132')
90          open (unit=ios,status='unknown',file='giant.out')
91      endif
92  C      DO 1010 I=ITAPE1,ITAPE6
93
```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19
PROGRAM NBDL_GIANT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
94 1010 OPEN (UNIT=I,STATUS='SCRATCH',FORM='UNFORMATTED')
95 C
96 C Initialize job title, page count, and data set identifications
```

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```
97  C
98      I  Page=0
99      CALL CLR
100     write(*,*) char(7)
101  C
102 C Perform data input and structuring phase, then close input files.
103  C
104      CALL CLR
105      CALL PHASE1
106      CLOSE (IN)
107      CLOSE (IMAGES)
108  C
109 C Perform triangulation phase
110  C
111      OPEN (UNIT=ITAPE0,STATUS='UNKNOWN')
112      OPEN (UNIT=ITAPE7,STATUS='SCRATCH',FORM='UNFORMATTED')
113  C
114      CALL CLR
115      WRITE (*,'(37X,''PHASE 2'')')
116      CALL PHASE2
117  C
118 C Perform data output phase
119  C
120      CLOSE (ITAPE0)
121      CLOSE (ITAPE1)
122      CALL CLR
123      WRITE (*,'(37X,''PHASE 3'')')
124      CALL PHASE3
125      write(*,*) char(7)
126      CALL CLR
127      write(*,*) char(7)
128      if(ians==0)then
129          WRITE (*,"(////,26X,'Results are in ',a6,'.out.')")irun
130          WRITE (*,"(////,16X,'Initial Conditions Results are in ',a6,
131          '.ic.')")irun
132      elseif(ians==1)then
133          WRITE (*,"(////,26X,'Results are in ',a4,'head.out.')")fn(1:4)
134      elseif(ians==2)then
135          WRITE (*,"(////,26X,'Results are in ',a4,'body.out.')")fn(1:4)
136      else
137          WRITE (*,"(////,26X,'Results are in giant.out.')")
138      endif
139      END
```

Subroutines

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SUBROUTINE STUFFP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
4426 C*****
4427      SUBROUTINE STUFFP(ID2, OBJECT)
4428 C Search object point ids to find matching ids in anthropometry list
4429 C
4430      REAL*8 P, OBJECT(3)
4431 C      CHARACTER*4 ID(15)
4432      COMMON /TAPES/ IN,IO,IOS, IDUM(15)
4433      COMMON /ANTHR/ IANTH, P(15, 3)
4434      DIMENSION ID(15)
4435      DATA ID/'r1-l','r2-l','r3-l','r4-l',
4436      .      'r1-r','r2-r','r3-r','r4-r', ' lon',' ron',
4437      .      'igin','b_Lf','b_Rt','eTop', 'eBot' / ! 15
4438      DO I=1, 15
```

Anthropometry and Initial Conditions Photogrammetric Program

```
4439      IF (ID2.EQ.ID(I))THEN
4440  C
4441  C Stuff object points into corresponding locations in array P
4442  C
4443      DO J=1, 3
4444          P(I, J)=OBJECT(J)
4445      enddo
4446      RETURN
4447      ENDIF
4448  enddo
4449  END
```

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ROUTINE ANTHRO Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4450  C*****
4451      SUBROUTINE ANTHRO
4452  C Verify that we have the 18/13 needed anthro points,
4453  C call the routine to find the transformations & print results
4454  C
4455      REAL*8 P, X(3), AB(3, 3)
4456      COMMON /TAPES/ IN, IO, IOS, IDUM(15)
4457      COMMON /ANTHR/IANTH, P(15, 3)
4458      CHARACTER*4 TYPE(2) //'HEAD', 'BODY'/
4459  C
4460      CALL NEWPAG
4461      WRITE(IO, '(4XA40//)')'ANTHROPOMETRY      OUTPUT'
4462      WRITE(IOS, '(2XA40//)')'ANTHROPOMETRY      OUTPUT'
4463      I1=1
4464      I2=10
4465      IF(IANTH.EQ.2)THEN
4466          I1=11
4467          I2=15
4468      ENDIF
4469      DO 10 I=I1, I2
4470      IF(P(I,3).EQ.0.)THEN
4471          WRITE(IO, *)' Can''t find 10 head or 5 body points--halting'
4472          WRITE(IOS, *)' Can''t find 10 head or 5 body points--halting'
4473          RETURN
4474      ENDIF
4475  10  CONTINUE
4476  C ****
4477      CALL NBDL (X, AB)
4478      WRITE(IO, 8) TYPE(IANTH), X, TYPE(IANTH), AB
4479      WRITE(IOS, 9) TYPE(IANTH), X, TYPE(IANTH), AB
4480      8 FORMAT(38X'T-PLATE ORIGIN WITH RESPECT TO ',A4,
4481      . ' ANATOMICAL ORIGIN'
4482      . //41X'X= '2PF8.4,'cm    Y= 'F8.4,'cm    Z= 'F8.4,'cm'OP///
4483      . 35X'T-PLATE ORIENTATION WITH RESPECT TO ',A4,
4484      . ' ANATOMICAL SYSTEM' //3(47X,3F11.6/))
4485      9 FORMAT(14X'T-PLATE ORIGIN WITH RESPECT TO ',A4,
4486      . ' ANATOMICAL ORIGIN'
4487      . //17X'X= '2PF8.4,'cm    Y= 'F8.4,'cm    Z= 'F8.4,'cm'OP///
4488      . 11X'T-PLATE ORIENTATION WITH RESPECT TO ',A4,
4489      . ' ANATOMICAL SYSTEM' //3(23X,3F11.6/))
4490      END
```

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SUBROUTINE UVEC Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
4491 C*****  
4492      SUBROUTINE UVEC (A,K)  
4493 C Make a unit vector: A(K,-) = A(K,-) / MAGNITUDE (A(K, -))  
4494 C  
4495      IMPLICIT DOUBLE PRECISION (A-H,O-Z)  
4496      DIMENSION A(3, 3)  
4497 C  
4498      B=0  
4499      DO 10 I=1, 3  
4500 10      B=B+A(K, I)**2  
4501      B=DSQRT(B)  
4502      DO 20 I=1, 3  
4503 20      A(K, I)=A(K, I)/B  
4504      END
```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19
SUBROUTINE NBDL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
4505 C*****  
4506      SUBROUTINE NBDL (X, AB)  
4507 C Find the origin & transformation matrix of the T-plate relative to the  
4508 C head (body) anatomical origin in the head (body) anatomical coord system  
4509 C  
4510      IMPLICIT DOUBLE PRECISION (A-H,O-Z)  
4511      COMMON /ANTHR/IANTH, P(15, 3)  
4512      DIMENSION X(3), AB(3, 3), A(3, 3), B(3, 3), Q(3)  
4513 C  
4514      C=0.D0  
4515      D=0.D0  
4516      IF(IANTH.EQ.1)THEN  
4517          call extrapolate ! 1-4-->4 & 5-8-->8  
4518          DO 10 I=1, 3  
4519      C Find origin of Head Anatomical Coordinate System  
4520          X(I)=(P(4,I)+P(8,I))/2  
4521      C Find x-axis  
4522          A(1,I)=(P(9,I)+P(10,I))/2-X(I)  
4523      C Find origin of T-plate  
4524          Q(I)=0  
4525      C Find x-axis of T-plate  
4526          B(1,I)=0  
4527          if(i==1)B(1,I)=1  
4528      C Find approx. y-axes  
4529          A(2,I)=P(4,I)-X(I)  
4530          B(2,I)=0  
4531          if(i==2)B(2,I)=1  
4532      C Interchange ltp and rtp when processing a-plate (180 rot re z)  
4533      C B(2,I)=P(12,I)-P(11,I) !rhesus right-left xxxxx  
4534      C Find vector from head anat to T-plate  
4535 10      Q(I)=Q(I)-X(I)  
4536      ELSE  
4537          DO 11 I=1, 3  
4538      C Find origin of Body Anatomical Coordinate System  
4539          X(I)=P(11,I)  
4540      C Find x-axis  
4541          A(1,I)=X(I)-(P(14,I)+P(15,I))/2  
4542      C Find origin of T-plate  
4543          Q(I)=0
```

Anthropometry and Initial Conditions Photogrammetric Program

```
4544 C Find x-axis of T-plate
4545     B(1,I)=0
4546     if(i==1)B(1,I)=1
4547 C Find approx. y-axes
4548     A(2,I)=P(12,I)-P(13,I)
4549     B(2,I)=0
4550     if(i==2)B(2,I)=1
4551 C Find vector from body anat to T-plate
4552 11     Q(I)=Q(I)-X(I)
4553     ENDIF
```

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SUBROUTINE NBDL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4554 C Make unit vectors of x-axes
4555     CALL UVEC(A, 1)
4556     CALL UVEC(B, 1)
4557 C Find components of the approx y-axes along the respective x-axes
4558     DO 20 I=1, 3
4559     C=C+A(1,I)*A(2,I)
4560 20     D=D+B(1,I)*B(2,I)
4561 C Subtract these to yield y-axes perpendicular to the resp x-axes
4562     DO 30 I=1, 3
4563     A(2,I)=A(2,I)-C*A(1,I)
4564 30     B(2,I)=B(2,I)-D*B(1,I)
4565 C Make them of unit length
4566     CALL UVEC(A, 2)
4567     CALL UVEC(B, 2)
4568 C Find the z-axes by taking the cross products of the x-axes & y-axes
4569     DO 40 I=1, 3
4570     J=I+1
4571     IF(J.GT.3)J=J-3
4572     K=I+2
4573     IF(K.GT.3)K=K-3
4574     A(3,I)=A(1,J)*A(2,K)-A(1,K)*A(2,J)
4575 40     B(3,I)=B(1,J)*B(2,K)-B(1,K)*B(2,J)
4576 C Find the components of the transformation vector and matrix in
4577 C the head (body) anatomical coordinate system
4578     DO 50 I=1, 3
4579     X(I)=0.D0
4580     DO 50 J=1, 3
4581     X(I)=X(I)+Q(J)*A(I,J)
4582     AB(J,I)=0.D0
4583     DO 50 K=1, 3
4584 50     AB(J,I)=AB(J,I)+B(I,K)*A(J,K)
4585     END
```

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SUBROUTINE EXTRAPOLATE Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
4586 C
4587     SUBROUTINE EXTRAPOLATE
4588     common /offset/off(2)
4589     COMMON /ANTH/IANTH, P(15, 3)
4590     real*8 p, x(4),y(4),z(4),t(4)
4591     n=4
4592     do k=1, 2
4593         t1=0.d0
```

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```

4594      t2=0.d0
4595      x1=0.d0
4596      xt=0.d0
4597      y1=0.d0
4598      yt=0.d0
4599      z1=0.d0
4600      zt=0.d0
4601      do i=1,n
4602          j=i+4*(k-1)
4603          t(i)=(i-1)*25.4d0      ! 0, 1, 2, 3 in inches
4604          t1=t1+t(i)
4605          t2=t2+t(i)*t(i)
4606          x(i)=p(j,1)
4607          x1=x1+x(i)
4608          xt=xt+t(i)*x(i)
4609          y(i)=p(j,2)
4610          y1=y1+y(i)
4611          yt=yt+t(i)*y(i)
4612          z(i)=p(j,3)
4613          z1=z1+z(i)
4614          zt=zt+t(i)*z(i)
4615      enddo
4616      den=n*t2-t1*t1
4617      ax= ( n*xt-x1*t1)/den
4618      bx=-(t1*xt-x1*t2)/den
4619      ay= ( n*yt-y1*t1)/den
4620      by=-(t1*yt-y1*t2)/den
4621      az= ( n*zt-z1*t1)/den
4622      bz=-(t1*zt-z1*t2)/den
4623      p(4*k,1)=ax*off(k)*25.4d0+bx
4624      p(4*k,2)=ay*off(k)*25.4d0+by
4625      p(4*k,3)=az*off(k)*25.4d0+bz
4626
4627      enddo
4628  end

```

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SUBROUTINE GETICV Compiling Options:
/N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```

4629  *****
4630      SUBROUTINE GETICV(ID2,OBJECT,GPCOV)
4631  C
4632  C  Search object point ids to find matching ids of targets on the head,
4633  C  mouth and neck. Desired variables are saved.
4634  C
4635      REAL*8      OBJECT(3),GPCOV(3,3),VARH,VARM,VARN,VAR2
4636      CHARACTER*4   VAR
4637  C
4638      COMMON /TAPES/  IN,IO,IOS,IOIC,IDUM(14)
4639      COMMON /CONS/   NH,NM,NN,VARH(24,13),VARM(24,13),VARN(24,13)
4640  C
4641      DIMENSION      IDH(24),IDM(24),IDN(24)
4642  C
4643      DATA IDH // 'hrc1','hrc2','hrc3','hrc4',
4644      .      'hrc5','hrc6','hrc7','hrc8',
4645      .      'hcc1','hcc2','hcc3','hcc4',
4646      .      'hcc5','hcc6','hcc7','hcc8',
4647      .      'hlc1','hlc2','hlc3','hlc4',
4648      .      'hlc5','hlc6','hlc7','hlc8',
4649      DATA IDM // 'mrc1','mrc2','mrc3','mrc4',
4650      .      'mrc5','mrc6','mrc7','mrc8',
4651      .      'mcc1','mcc2','mcc3','mcc4',

```

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```
4652      .      'mcc5','mcc6','mcc7','mcc8',
4653      .      'mlc1','mlc2','mlc3','mlc4',
4654      .      'mlc5','mlc6','mlc7','mlc8'
4655      DATA IDN //'nrc1','nrc2','nrc3','nrc4',
4656      .      'nrc5','nrc6','nrc7','nrc8',
4657      .      'ncc1','ncc2','ncc3','ncc4',
4658      .      'ncc5','ncc6','ncc7','ncc8',
4659      .      'nlc1','nlc2','nlc3','nlc4',
4660      .      'nlc5','nlc6','nlc7','nlc8'
4661 C
4662      EQUIVALENCE (VAR,VAR2)
4663 C
4664      DO 40 I=1,24
4665 C
4666 C  SAVE MOUTH DATA
4667 C
4668      IF(ID2.EQ.IDM(I)) THEN
4669 C
4670 C  ENCODE CHARACTER DATA
4671      WRITE(VAR,50) ID2
4672 C
4673      NM=NM+1
4674      VARM(I,1)=VAR2
4675      VARM(I,2)=OBJECT(1)
4676      VARM(I,3)=OBJECT(2)
4677      VARM(I,4)=OBJECT(3)
```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19
SUBROUTINE GETICV Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
4678      K=4
4679      DO 10 J=1,3
4680      DO 10 J1=1,3
4681      K=K+1
4682      10  VARM(I,K)=GPCOV(J,J1)
4683 C
4684 C  SAVE HEAD DATA
4685 C
4686      ELSE IF(ID2.EQ.IDH(I)) THEN
4687      WRITE(VAR,50) ID2
4688      NH=NH+1
4689      VARH(I,1)=VAR2
4690      VARH(I,2)=OBJECT(1)
4691      VARH(I,3)=OBJECT(2)
4692      VARH(I,4)=OBJECT(3)
4693      K=4
4694      DO 20 J=1,3
4695      DO 20 J1=1,3
4696      K=K+1
4697      20  VARH(I,K)=GPCOV(J,J1)
4698 C
4699 C  SAVE NECK DATA
4700 C
4701      ELSE IF(ID2.EQ.IDN(I)) THEN
4702      WRITE(VAR,50) ID2
4703      NN=NN+1
4704      VARN(I,1)=VAR2
4705      VARN(I,2)=OBJECT(1)
4706      VARN(I,3)=OBJECT(2)
4707      VARN(I,4)=OBJECT(3)
4708      K=4
4709      DO 30 J=1,3
```

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```
4710      DO 30 J1=1,3
4711      K=K+1
4712      30  VARN(I,K)=GPCOV(J,J1)
4713      ENDIF
4714  C
4715      40  CONTINUE
4716  C
4717      50  FORMAT(A4)
4718      RETURN
4719      END
```

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SUBROUTINE ICONS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
4720  C*****
4721      SUBROUTINE ICONS
4722  C
4723  C  Write Initial Conditions data to a file.
4724  C
4725      REAL*8 VARH,VARM,VARN
4726  C
4727      COMMON /TAPES/ IN,IO,IOS,IOIC,IDUM(14)
4728      COMMON /CONS/ NH,NM,NN,VARH(24,13),VARM(24,13),VARN(24,13)
4729  C
4730      CHARACTER*4 TYPE(3) //'MOUT', 'HEAD', 'NECK'/
4731  C
4732  C  WRITE MOUTH DATA
4733  C
4734      IF(NM.EQ.0) GO TO 20
4735      WRITE(IOIC,100) TYPE(1)
4736      DO 10 I=1,24
4737      IF(VARM(I,1) .EQ. 0) GO TO 10
4738      WRITE(IOIC,100) VARM(I,1)
4739      J1=2
4740      J2=4
4741      DO 5 I1=1,4
4742      WRITE(IOIC,200) (VARM(I,J),J=J1,J2)
4743      J1=J2+1
4744      J2=J2+3
4745      5  CONTINUE
4746      10 CONTINUE
4747      WRITE(IOIC,300)
4748  C
4749  C  WRITE HEAD DATA
4750  C
4751      20 IF(NH.EQ.0) GO TO 40
4752      WRITE(IOIC,100) TYPE(2)
4753      DO 30 I=1,24
4754      IF(VARH(I,1) .EQ. 0) GO TO 30
4755      WRITE(IOIC,100) VARH(I,1)
4756      J1=2
4757      J2=4
4758      DO 25 I1=1,4
4759      WRITE(IOIC,200) (VARH(I,J),J=J1,J2)
4760      J1=J2+1
4761      J2=J2+3
4762      25 CONTINUE
4763      30 CONTINUE
4764      WRITE(IOIC,300)
4765  C
4766  C  WRITE NECK DATA
4767  C
```

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4768 40 IF(NN.EQ.0) GO TO 60

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SUBROUTINE ICONS Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

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```
4769      WRITE(IOIC,100) TYPE(3)
4770      DO 50 I=1,24
4771      IF(VARN(I,1) .EQ. 0) GO TO 50
4772      WRITE(IOIC,100) VARN(I,1)
4773      J1=2
4774      J2=4
4775      DO 45 I1=1,4
4776      WRITE(IOIC,200) (VARN(I,J),J=J1,J2)
4777      J1=J2+1
4778      J2=J2+3
4779      45 CONTINUE
4780      50 CONTINUE
4781      60 WRITE(IOIC,300)
4782      WRITE(IOIC,300)
4783      C
4784      C      RESET VARIABLE COUNTERS
4785      C
4786      NH=0
4787      NM=0
4788      NN=0
4789      C
4790      100 FORMAT(A4)
4791      200 FORMAT(3(D11.4,1X))
4792      300 FORMAT('EOFEOF')
4793      C
4794      END
```

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